Dietary intake and overweight among adolescents with asthma

A comparison with healthy control subjects

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Summary

Aims

Several studies have reported an association between a diet low in fruits, vegetables, vitamin C and overweight and the presence of asthma. The primary aim of the present study was to compare the intake of nutrients and food items in asthmatic and healthy adolescents and secondarily to compare the intake with the Nordic Nutrition Recommendations (NNR). We also wanted to determine the occurrence of overweight in asthmatic compared to healthy adolescents.

Subjects and methods

A total of 169 adolescents (13 years old) were included in the study, 93 with a history of asthma (51 with current asthma) and 76 healthy control subjects. Their entire food intake was registered for four days using a validated 18-page pre-coded food diary.

Results

The intake of sugar-containing soft drinks was significantly higher in adolescents with asthma compared to healthy adolescents, as also was the intake of snacks. All groups had an intake of saturated fat and added sugars exceeding the Nordic Nutrition recommendations, while the intake of fruits and vegetables, fibre, vitamin D, calcium and magnesium was mostly lower than recommended. The intake of vitamin C wasadequate for all groups. The prevalence of overweight (including those obese) was 19.3% in adolescents with asthma compared to 11.8% in the control group.

Conclusion

The higher consumption of sugar-containing soft drinks and snacks compared to healthy controls suggest a less healthy diet in asthmatic adolescents. There is a demand for additional dietary research in children and adolescents with asthma, also examining gender differences. The dietary intake in all girls and boys had a potential for improvement compared to the Nordic Nutrition recommendations.

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2. Consent form
3. Precoded food diary (18 pages)
4. Photographic booklet
5. Instruction folder
6. Approvement from the Medical Research Ethics Committee
7. Approvement from the Data Inspectorate of Norway

List of Abbreviations

BMI	Body Mass Index
BMR	Basal metabolic rate
BMR_{est}	BMR estimated
CI	Confidence Interval
E%	Energy percentage
EI	Energy intake
ECA	Environment and Childhood Asthma
FFQ	Food frequency questionnaire
IgE	Immunoglobulin E
IOTF	International Task Force on Obesity
MJ	Mega Joule
NaCl	Natrium Chloride
NNR	Nordic Nutrition Recommendation
NS	Non significant
RI	Recommended intake
AR	Average Requirement
SD	Standard Deviation
SMS	Short Message Service
SPT	Skin Prick Test
WC	Waist circumference
WHR	Waist hip ratio

1. Introduction

1.1 Asthma

The ”British guideline on the management of asthma” (1) emphasizes that the diagnosis of asthma is a clinical diagnose. There are many descriptions existing, and these guidelines use the International Consensus Report’s description: “a chronic inflammatory disorder of the airways…in susceptible individuals, inflammatory symptoms are usually associated with widespread but variable airflow obstruction and an increase in airway response to a variety of stimuli. Obstruction is often reversible, either spontaneously or with treatment” (2).

It may be challenging to diagnose asthma in infants and preschool children due to the various asthma phenotypes in the pre-school age. In schoolchildren the diagnosis can be confirmed by variability in measures of lung function and bronchial hyper-responsiveness. A variety of symptoms can occur in those with asthma: wheeze, shortness of breath, chest tightness and cough. In asthma these symptoms tend to be variable, intermittent, worse at night and provoked by several different triggers including exercise. Viral infections, smoke, air pollution, inhaled allergens and climatic conditions are other examples of triggers that can provoke symptoms.

Asthma is divided into allergic and non-allergic asthma (3). Allergic sensitization is more common in children with asthma than in asthmatic adults. IgE antibodies are then produced to an allergen, but this does not necessarily cause symptoms. Of school children with asthma, 56,1% were sensitized towards one or more common allergens such as house dust mites, animal danders, grass and birch pollen (4).

1.1.1 Prevalence

After several decades with an increasing prevalence of asthma observed in the Western world (5;6), levelling off in childhood asthma prevalence is reported in some

studies (7;8), although still increasing prevalence are more often reported than levelling off (5;9). The highest prevalence ever reported in Scandinavia, was reported from Oslo, - a 20.2% lifetime prevalence of asthma among 10 year-old-children (4). The highest prevalence rates have usually been reported in English speaking countries, - in the mid-1990s doctor diagnosed asthma was reported in approximately 20% of British children (10;11).

The increased prevalence of asthma seems to be part of a generalised trend of increasing prevalence of allergic sensitisation and allergic disease (12). Extensive research into the cause, pathophysiology and management of asthma is taking place all over the world.

1.1.2 Treatment

A decrease in total days of hospital treatment for children with asthma above 4 years reflects the changes in therapeutic approach that has occurred the last decades (13;14). Inhaled steroids is an important anti-inflammatory treatment and is now the most important asthma treatment. They are very effective in childhood asthma (15). Also other kinds of treatment (leukotriene antagonists) and combination therapy (inhaled ß2-agonists together with inhaled steroids) can be useful in childhood (15), but documentation in children is lacking for combination therapy. Using this treatment, the results should always be monitored individually.

Concerning dietary manipulation as part of the asthma management, there is so far little or no evidence of benefit amongst patients with asthma (1).

1.2 Risk factors for developing asthma

1.2.1 Genetic factors

Asthma is known as a multi-factorial disease that develops in individuals with genetic susceptibility (16). The interaction between genotype and environment plays a crucial role (17). It is suggested that there are many genes having a moderate effect that determine the susceptibility to asthma (12;18).

The most clearly defined risk factor for atopic diseases (allergy/asthma/atopic dermatitis) in children is a family history of atopy. Asthma is linked to both parental and sibling atopy, but the strongest association is with maternal atopy (1). The risk for developing atopic diseases is 50-70% if one or both of the parents have any atopic diseases (19). Of all children in a 10-year follow up of a birth cohort study, at least one positive SPT was found among 29,3%, demonstrating allergic sensitization in a normal population (4). Unfortunately there are few twin studies, and further research is needed to look upon the connection between genetic factors and development of asthma.

1.2.2 Gender and age

Male sex is a risk factor for asthma in childhood (20). Studies also demonstrate higher total IgE and more frequent allergic sensitization in boys (21;22). Female sex is a risk factor for persistence of asthma in the transition from childhood to adulthood, and it is therefore a reversed gender difference for asthma in young adults (20). After the age of ten years, more girls than boys aquire asthma.

1.2.3 Environmental factors

A strong association is seen between allergen exposure in early life and sensitisation to these allergens. Genetically predisposed children who are exposed to certain environmental factors are believed to be at increased risk of developing asthma.

On the other hand epidemiological studies suggest that close contact with a pet in very early infancy may reduce the subsequent prevalence of allergy and asthma, especially in children without asthma/allergy in primary relatives (23-25).

In those having asthma, reducing the environmental exposure to allergens (i.e. house dust mite and pets) has shown disappointing results (26;27). On the other hand, moving house dust mite sensitized children to a high altitude and a allergen-free environment resulted in less asthmatic symptoms and better asthma control in the children (28).

Exposure to second-hand smoke is a well-known risk factor for asthma in childhood. Maternal smoking during pregnancy is associated with reduced lung function at birth and higher prevalence of wheezing illness in early childhood (29-31).

Viral associated wheeze in infancy is also often followed by wheeze in early childhood (32). Some viral infections may have a pathophysiological role in the development of asthma (13;33). These infections are also known to cause exacerbation of already existing asthma. Many patients report their asthma as having started at the time of a respiratory tract viral infections (13;33) .

Other factors, including lower maternal age, maternal diet, duration of breastfeeding, prematurity and low birthweight have been suggested as important in the contribution to the rise in the asthma prevalence, but none of these can explain the rapid rise over the recent decades (12).

A more wealthy lifestyle has many characteristics that could be involved in the cause of asthma and allergy. Which of these being responsible has not been clearly established. The hygiene hypothesis suggests that children growing up in modern societies are less exposed to infections which provokes the immune system to polarise towards a greater risk of allergic disease (34). Lately the hygiene hypothesis has received less attention (35).

1.2.4 Diet

The western modern lifestyle includes a more sedentary behaviour and a dietary change, which has been postulated to contribute to the recent increase in asthma and atopy (36). Epidemiological studies in adults and children have reported beneficial associations between dietary nutrients and asthma and atopic disease. The results of intervention supplementation studies in established disease have on the other hand been disappointing (36). The nutrients most often implicated in the etiology of asthma, and their postulated mechanism of effect is shown in table 1.

Table 1. Nutrients or nutrient groups implicated in the etiology of asthma, and their postulated mechanism of effect

Nutrient(s)	**Activity and Potential Mechanims of Effect**
Vitamin A,C,E	Antioxidant;protection against endogenous and exogeneous oxidant inflammation
Vitamin C	Prostaglandin inhibition
Vitamin E	Membrane stabilization, inhibition of IgE production
Flavones and flavonoids	Antioxidant;mast cell stabilization
Magnesium	Smooth muscle relaxation, mast cell stabilization
Selenium	Antioxidant cofactor in glutathione peroxidase
Copper, zinc	Antioxidant cofactors in superoxide dismutase
n-3 fatty acids	Leukotriene substitution, stabilization of inflammatory cell membranes
n-6 polyunsaturated/trans fatty acids	Increased eicosanoid production
Sodium	Increased smooth muscle contraction

Adapted from Mc Keever TM, Britton J. Diet and Asthma. Am J Respir Crit Care Med 170,725-729,2004 .

Food groups like fruits and vegetables contain positive dietary factors (i.e. antioxidants) which are considered to have a positive influence on respiratory symptoms and lung function (36). Many important antioxidants cannot be quantified. Some studies have therefore investigated the total intake of fruits, juices and vegetables and seen a positive influence on children's lung function (37-39). It is suggested that intervention studies based on dietary advice to increase fruit and vegetable intake rather than on supplementation is needed (40).

1.2.5 Physical activity

Reduced fitness at 8-9 years of age has been reported to be related to development of asthma over the next 11 years (41).

Physical activity is also an important part of daily life and play in children, and important for growth and development. Mastering of physical activity by mastering exercise induced asthma is one of the main objectives of asthma treatment guidelines. Van Gent et al found similar levels of physical activity on 7-10 years old children with undiagnosed asthma, diagnosed asthma and controls (42). On the other hand Ownby et al found higher levels of physical activity in children with asthma (43). Others have reported decreased physical activity among school-age children with a diagnosis of asthma (44) and also in preschool-age children (45). Being less physical active increases the risk for obesity, and there are several studies looking at the connection between physical activity, obesity and an increased risk for developing asthma.

1.2.6 Obesity and overweight

It is challenging to compare studies examining a possible association between asthma and asthma-like symptoms and obesity/overweight due to the design of the studies and the outcome variables of the data in these studies (46). There is a variation in whether asthma/wheeze is doctor diagnosed or whether it is based on parent-reported symptoms. Further, the definitions of overweight and obesity in these studies vary.

There are studies finding a relation between current asthma and BMI (47-49). Gold et al (48) included 9378 children (7-14 yr of age) from four cities in USA. BMI was a predictor of respiratory illness. Bibi et al (47) included 5984 children, and doctor diagnosed asthma was more frequently diagnosed among obese children than non-obese. Oddy et al (49) followed 2602 children from birth to six years of age and showed that an increased BMI was a risk factor for childhood asthma. Several prospective studies of obesity/overweight and asthma among paediatric patients have yielded inconsistent conclusions (50). Mechanical, immunological, hormonal and inflammatory effects of obesity are mechanisms suggested to have importance both in the development and in the persistence of asthma. Castro-Rodriguez et al found that females becoming overweight or obese between 6 and 11 years of age were 7 times more likely to develop new asthma symptoms at age 11 or 13 (51).

A small randomised parallel group study has shown improved asthma control following weight reduction in obese patients with asthma (52). The ”British guideline on the management of asthma” recommends weight reduction in obese patients with asthma to improve asthma control (1).

1.3 Weight, height and BMI

It is clear that the prevalence of overweight and obesity among adolescents is increasing and without exception, reports have produced the same findings (53;54). This is also seen in Norway, and the tendency is the same in childhood and adulthood. In a Norwegian population of eight grade pupils, the prevalence of overweight and obesity was 11.5% and 1.8% (54). There was also seen a significant increase in the proportion of overweight and obese children/adolescents from 1993 to 2000 (54).

Several studies have investigated possible associations between obesity and asthma and asthma like symptoms (46). The studies may be difficult to compare due to different definitions of overweight and obesity as well as the definition of asthma and

asthma-like symptoms. The proposed mechanisms for a relationship between overweight and asthma includes both mechanical factors related to lung function as well as immunologic mechanisms. Weight reduction in asthmatics has shown significantly improvement, both on lung function, symptoms, morbidity and health status (52;55).

2. Objectives

2.1 Introduction

To our knowledge, the dietary intake of Norwegian adolescents with asthma has not previously been assessed. There is also a lack of data concerning obesity and overweight within the same group. An increasing risk of developing asthma or asthma symptoms in obese children and adolescents is reported (56). Dietary data from patients and anthropometric data (e. g. weight, height) are important information to base dietary advice on.

Several studies focus on the importance of vitamin C and fruits and vegetables in asthmatic patients. Furthermore, the role of those food groups yielding few nutrients, i. e. sugar-containing soft drinks and sweets, are important to investigate in asthma patients.

2.2 Objectives

The overall objective of the present study was:

Have adolescents with asthma a different composition of their diet compared to healthy adolescents? More precisely:

i) Is the intake of energy yielding nutrients such as fat and sugar higher in adolescents with asthma compared to healthy adolescents?

ii) Is the intake of sugar containing soft-drinks and sweets higher in the asthmatic adolescents compared to healthy adolescents?

iii) Is the intake of fruits/berries (including fruit juices), vegetables and potatoes lower in those with asthma compared to healthy adolescents?

iv) Is the intake of vitamin C (included vitamin C from supplements) lower in asthmatic adolescents compared to healthy adolescents?

Secondary objectives were to compare adolescents with asthma and age-matched healthy adolescents with respect to:

v) if the adolescent's (asthmatic and healthy) intake of micro- and macronutrients is satisfactory in relationship to the Nordic Nutrient Recommendations?

Also,

vii) are adolescents with asthma more often overweight or obese compared to healthy adolescents, and if so; are there differences in their diet?

Finally, comparing adolescents with asthma and age-matched healthy adolescents:

viii) are there gender differences related to the composition of the diet or the intake of micro- and macronutrients?

Description of methods, and presentation of results and a discussion of the methods and results are also found in the enclosed article manuscript entitled "Higher intake of sugar containing soft drinks in adolescents with asthma compared to healthy control subjects."

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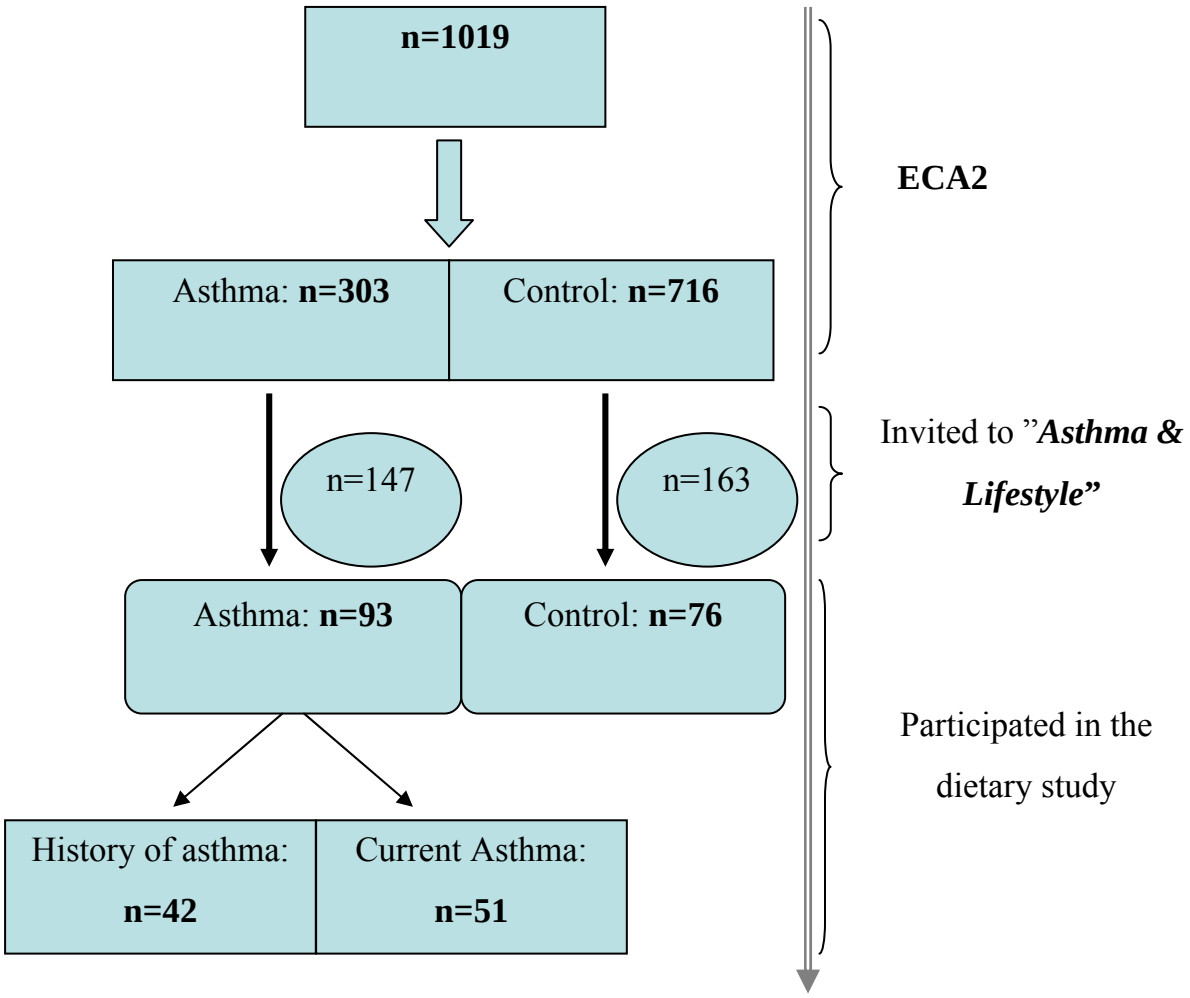
3. Methods

3.1 Subjects

The adolescents in the present study ("Asthma and Lifestyle") are recruited from a birth cohort "Environment and Childhood Asthma" (ECA), established in Oslo in 1992 and described elsewhere (57). The 10 year follow-up study (ECA2) was conducted between September 2001 and July 2004 and included 1019 of 1215 children (4;57), see figure 1 for flow chart. Of these, 303 children had asthma (146 had a history of asthma, and 157 had current asthma) and 716 healthy children (4). A randomized selection of 147 children with history of asthma at 10 years of age (cases) and 163 healthy children, i.e. no asthma at any time up to 10 years of age (controls) was made. The controls were the children born closest in time to a defined case. They were not matched by gender as this neutralizes the natural imbalance of asthma prevalence between the genders. Results from the study have been reported in several journals (29;30;58).

Figure 1 Study design. ECA2 and "Asthma & Lifestyle"



Asthma was defined by at least two of the following three criteria full filled:

1. dyspnoea, chest tightness and/or wheezing 0-3 years and/or after three years
2. received a doctor diagnosis of asthma
3. used asthma medication (ß-2 agonist, sodium chromoglycate, corticosteroids, leukotriene antagonists and/or aminophylline) 0-3 years and/or after three years

Current asthma was defined as asthma (by definition above) pluss at least one of the following:

1. dyspnoea, chest tightness and/or wheezing in the last 12 months
2. used asthma medication (ß-2 agonist, sodium chromoglycate, corticosteroids, leukotriene antagonists and/or aminophylline) in the last 12 months

A hundred and seventy five adolescents were included in "Asthma & Lifestyle", and 169 (93 children with asthma ever and 76 healthy children) completed the food diaries (96.6%). For those six who did not complete the food diaries the reasons were: one was ill and hospitalized during the registration, one experienced the task too demanding, two were excluded because they had completed a three day registration instead of a four day registration (three weekdays, both of them lacking a "weekend day"), one was excluded because he didn't full fill the inclusion criteria, and the last one did not return the food diaries.

3.2 Anthropometric measures

Weight and height are used to calculate BMI (BMI=weight(kg)/height^2 (m^2)). The international cut-off points for BMI for overweight and obesity, based on percentile curves defined to pass through the BMI of 25 and 30 kg/ m^2 at age 18 in a survey of

six nationally representative growth studies conducted by Cole et al (59), are often used to produce estimates of the prevalence of overweight and obesity. The present study used the cut-off points published by Cole et al to estimate the prevalence of overweight and obesity (59). There are no published national reference values or cut-off points in Norway concerning overweight and obesity in childhood and adolescence.

The age references for waist circumference (WC) in the Netherlands were constructed using cross-sectional data obtained from 14 500 children of Dutch origin (age range 0-21 years) (60). The suggested cut-off points for WC for age (years) for boys and girls aged 2.0-21.0 years are based on the IOTF cut-off criteria for overweight and obesity in the Dutch reference population. In the present study these cut-off points for WC for 13 years old boys and girls are used (60). There are no national reference values or cut-off points in Norway concerning WC in childhood or adolescence.

3.3 Food diary and calculations of dietary intake

The participants received four precoded food diaries, attachment 3, and were instructed how to record their entire food intake for four consecutive days (by a research assistant). In addition they watched an instruction video, and they were given a photographic booklet, attachment 4, and an instruction folder, attachment 5. The instruction folder gives detailed information about how to fill in the food diaries and also shows examples. The participants indicate an eating event by filling in how many units of each food item they have eaten in the correct time span. The day is divided into five time spans (from 0600 to 1000, from 1000 to 1400, etc). The food diary lists 277 drinks, food items and dishes grouped into the following sections: drinks, bread, spread on bread, yoghurt, breakfast, cereals, milk for breakfast cereals, meat dishes, fish dishes, other dishes, mixed salads, potatoes/rice/pasta, vegetables, sauces, dessert, cakes, fruit and berries, snacks, sweets and chocolate, supplements. Food amounts in the food diary are presented in predefined household units (i e

drinks are recorded in glasses) or as portions estimated from photographs in the photographic booklet. This booklet contains 13 colour photograph series, each with four different portion photographs ranging from small to large, attachment 4. Each food group in the food diary is also supplemented with open-end alternatives. The participants were instructed to either fill in the food diary immediately after each meal was finished, or record the food eaten on attached notepaper and then fill in the diary in the evening.
The data were scanned using the Teleform program, version 6.0 (Datascan, Oslo, Norway), and the daily intake of food items, energy and nutrients was computed using the food database and software system developed at the Department of Nutrition, University of Oslo, Norway (KBS version 4.9). The food database is mainly based on the official composition table (61), and is continuously supplemented with data on new food items and nutrient contents.

Corrections for losses in cooking were done when calculating nutrient contents. The use of cod liver oil and vitamin and mineral preparations were included in the nutrient calculation.

The recommendations intended for planning diets for groups of healthy individuals in the Nordic Nutrition Recommendations (NNR) (62), are mainly used as reference values when the dietary intake is evaluated in the present study. The recommended intake (RI) for vitamins and minerals for 13 years old girls and boys is used. Dietary reference values for evaluating the intake of these nutrients in dietary surveys are only available for adults, and is called average requirement (AR). For the energy yielding nutrients the values which are the population goals are used.

3.4 Estimation of underreporting of energy intake

Basal metabolic rate (BMR) is defined as the energy expenditure of an individual lying at physical and mental rest in a thermoneutral environment, about 12 hours after the previous meal (62). Because of the technical constraints of measurements of

BMR, determinants of energy requirements are usually based on predicted BMR, also called estimated BMR (hereafter called estimated BMR). This was calculated from equations based on weight, age and sex (62). (The equations are based on Schofield et al. 1985:WHO/FAO/UNU, 1985; and modified data, Commission of the European Communities, 1992 (63-65)). A comparison of energy intakes with estimates of BMR was used to calculate the number of respondents who underreported their energy intake. Goldberg's cut off values (66) are usually used to evaluate whether reported energy intakes are a plausible measure of the food consumed during an actual measurement period. For a period of four days, a ratio between energy intake and BMR (also called BMR factor) of less than 1.06 may indicate underreporting of energy intake (66).

3.5 Statistics

Continuous demographic data were presented as mean values with standard deviation (SD), with the exception of age which was given as mean with range. Categorical variables were presented as counts with percentage. Energy intake, nutrient intakes and intakes of selected food groups are presented as mean values with 95% confidence interval (CI). Differences between groups were analysed by a two-sample t-test. We have performed no adjustment for multiple testing. Analysis of variance was performed in order to assess the influence of gender, asthma and overweight on the intake of soft drinks with sugar whereas logistic regression analysis was performed to assess the effect of the intake of different food items, energy, nutrients and WC and BMI on the risk of developing asthma. We performed three separate logistic regression analyses. In the first analysis we assessed the different food items (fruits/vegetables/potatoes (recorded as one variable), snacks, soft drinks with sugar, diet soft drinks, milk/yoghurt, meat and fish) influence on the development of asthma at 13 years. The second analysis assessed the influence of energy, protein, fat, added sugar, fibre, retinol eq, folate, thiamine, α-tokoferol, vitamin D, vitamin C, riboflavin, iron, magnesium and calcium. In the third analysis we assessed WC and BMI in

addition to food components from the second analysis. In the analysis gender and parental asthma was considered risk-factors for asthma and were included in the models in addition to the intake of food items/energy/nutrients/WC/BMI. P-values of 0.05 or less were considered statistically significant. Statistical Package for Social Sciences (SPSS, Chicago, IL, USA) version 14.0 was used in the statistical analysis.

4. Results

Among the 169 adolescents, (♂/♀103/66) in the present study, 93 (30% ♀) had a history of asthma, 51 (22 % ♀) of these also had current asthma, and 76 had never had asthma (50% ♀) (table 1 in the enclosed article).
Adolescents with a history of asthma had higher WC (74.2 cm, controls: 72.0 cm, p=0.09) and weight (53.3 kg, controls 50.5 kg: p=0.07) compared to the healthy controls, although not statistically significant. Stratifying by gender the same tendency is seen (table 1 in the enclosed article). The percentage of overweight (including those obese) was 21.4% (n=9) in those having a history of asthma (excluding those with current asthma) and 17.6% (n=9, 1 of these obese) in those having current asthma, compared to 11.8% (n=9, 3 of these obese) in the control group (NS). Although there are few overweight adolescents, some details about their diet are given in the enclosed article.

4.1. Intake of food items

The intake of selected food items in adolescents with asthma and healthy adolescents are shown in five tables. The first table, table 2, shows the intake in those with current asthma, history of asthma and controls. Table 3.1, 3.2, 4.1 and 4.2 show the intake for girls and boys in the same groups.

Adolescents with asthma had significantly higher intake of sugar-containing soft drinks compared to the control group, p=0.05 for current asthma and p=0.04 for those with a history of asthma (table 2). The intake of snacks was also significantly higher for those with current asthma (p=0.04) compared to the healthy controls (table 2).
The intake of carbonated sugar-containing soft drinks is significantly higher in adolescents with current asthma (p=0.02) and with history of asthma (p=0.03) compared to the healthy controls, table 2.

Intake of fruits and vegetables (including potatoes, berries and fruit juices) was low compared to the recommended amount (500 g/day) both among asthmatic and control subjects (table 2).

Table 2. Daily intake (mean (95% CI) of selected food items in 13 yrs old adolescents with current asthma, history of asthma and control subjects

	Current asthma *n=51*	**Control** *n=76*	**p-value**[a]	**History of asthma** *n=93*	**p-value**[a b]
Vegetables (g)	66 (50-83)	87 (65-110)	0.14	70 (51-83)	0.19
Potatoes (fresh) (g)	35 (24-45)	33 (25-41)	0.82	37 (27-46)	0.52
Fruit/berries (incl juice) (g)	205 (146-264)	218 (173-263)	0.72	190 (153-227)	0.34
Fruits and vegetables (g)[c]	306 (239-373)	343 (287-399)	0.46	297 (254-339)	0.24
Fish (g)	29 (19-39)	21 (15-27)	0.14	25 (19-32)	0.33
Meat (g)	119 (99-139)	108 (93-123)	0.38	122 (107-137)	0.18

	Current asthma *n=51*	**Control** *n=76*	**p-value**[a]	**History of asthma** *n=93*	**p-value**[a b]
Sugar/sweets (g)	31 (21-40)	37 (31-44)	0.27	34 (26-43)	0.60
Soft drinks with sugar (g)[d]	283 (208-357)	199 (157-242)	0.05[e]	271 (219-323)	0.04[e]
Carbonated soft drinks with sugar (g)	205 (144-266)	125 (95-155)	0.02[e]	180 (138-221)	0.03[e]
Diet soft drinks (g)	110 (54-166)	113 (65-161)	0.94	165 (108-221)	0.16
Diet carbonated soft drinks (g)	74 (35.115)	67 (40-94)	0.80	106 (70-143)	0.09
Water (for drinking)(g)	496 (371-620)	471 (361-581)	0.77	529 (438-620)	0.42
Pizza (g)	49 (22-76)	56 (38-74)	0.66	49 (31-67)	0.57
Snacks (g)	14 (7-21)	7 (4-9)	0.04[e]	10 (6-14)	0.10
Dark bread (g)	17 (8-26)	21 (13-28)	0.52	19 (12-26)	0.76
White bread (g)	38 (26-49)	38 (29-46)	0.97	38 (37-30)	0.97
Milk and yoghurt (g)	323 (255-391)	340 (298-381)	0.69	316 (265-366)	0.48

Values are mean (95% Confidence Interval). [a] Two sample t test, [b] p-value related to controls, [c] includes vegetables, potatoes (fresh), fruits, berries and fruit juices, [d] includes sugar sweetened carbonated soft drinks and other sugar sweetened soft drinks, i.e. lemonade and iced tea (diet soft drinks are artificially sweetened soft drinks), [e] $p \leq 0.05$

Table 3.1 Daily intake of selected food items in 13 yrs old boys with current asthma and control subjects

	Case (n=40)			Control (n=38)			*P-value* [c]
	Mean[a]	Median	95%CI[b]	Mean [a]	Median	95%CI[b]	
Vegetables (g)	74	64	55-93	89	62	49-128	0.50
Potatoes (fresh) (g)	35	31	23-48	30	26	21-40	0.51
Fruits/berries (incl juice) (g)	213	161	140-285	209	159	148-270	0.94
Fruits and vegetables (g) [d]	322	270	242-402	328	269	243-412	0.92
Fish (g)	33	24	21-45	22	13	13-30	0.13
Meat (g)	130	125	109-151	113	103	89-137	0.28
Sugar/sweets (g)	29	16	18-40	44	41	34-55	0.05[e]
Soft drinks with sugar (g)[f]	281	240	195-367	248	225	178-318	0.56
Carbonated soft drinks (g)	216	158	145-287	159	161	110-208	0.19
Diet soft drinks (g)	131	0	61-201	162	0	75-248	0.58
Diet carb. soft drinks (g)	85	0	36-134	85	0	39-130	0.99
Water (for drinking) (g)	439	359	332-546	522	370	325-720	0.46
Pizza (g)	45	0	13-78	75	48	44-107	0.18
Snacks (g)	17	8	9-25	9	4	5-13	0.08
Dark bread (g)	20	0	8-31	17	0	9-25	0.70
White bread (g)	40	28	26-54	39	35	26-52	0.95
Milk/yoghurt (g)	348	303	268-428	380	362	318-441	0.53

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval, [c] Two-sample t-test, [d] includes vegetables, potatoes (fresh), fruits, berries and fruit juices, [e] $p \leq 0.05$, [f] includes sugar sweetened carbonated soft drinks and other sugar sweetened soft drinks (diet soft drinks are artificially sweetened soft drinks), i.e. lemonade and iced tea

The intake of sugar/sweets is significantly higher in healthy boys compared to boys with current asthma, p=0.05, table 3.1.

Table 3.2 Daily intake of selected food items in 13 yrs old girls with current asthma and control subjects

	Case (n=11)			Control (n=38)			*P-value* [c]
	Mean [a]	Median	95%CI [b]	Mean [a]	Median	95%CI [b]	
Vegetables (g)	40	30	13-67	86	77	63-109	0.09
Potatoes (fresh) (g)	32	35	9-55	36	35	23-49	0.73
Fruits/berries(incl juice)(g)	176	133	83-269	227	166	159-295	0.35
Fruits and vegetables [d] (g)	247	165	127-367	349	301	272-425	0.14
Fish (g)	17	12	3-31	20	8	12-28	0.65
Meat (g)	78	78	30-126	103	86	83-122	0.32
Sugar/sweets (g)	36	34	16-57	30	26	23-37	0.53
Soft drinks with sugar (g) [f]	290	208	116-464	151	125	105-197	0.11
Diet soft drinks (g)	34	0	-6-73	64	0	25-103	0.25
Carbonated soft drinks (g)	165	115	26-303	91	75	59-122	0.27
Diet carb. soft drinks (g)	34	0	-6-73	49	0	18-80	0.51
Water (for drinking) (g)	701	458	234-1169	420	350	312-528	0.22
Pizza (g)	62	45	8-117	37	0	19-55	0.35
Snacks (g)	3	2	-1-7	4	1	2-6	0.57
Dark bread (g)	7.0	0	-4-17	25	0	12-38	0.03 [e]
White bread (g)	30	25	12-49	36	25	24-47	0.59
Milk/yoghurt (g)	233	182	104-361	299	262	242-355	0.32

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval, [c] Two-sample t-test, [d] includes vegetables, potatoes (fresh), fruits, berries and fruit juices, [e] $p \leq 0.05$, [f] includes sugar sweetened carbonated soft drinks and other sugar sweetened soft drinks (diet soft drinks are artificially sweetened soft drinks), i.e. lemonade and iced tea

The intake of dark bread is lower in girls with current asthma compared to the healthy controls, p=0.03, table 3.2.

Table 4.1 Daily intake of selected food items in 13 yrs old boys with history of asthma and control subjects

	Case (n=65)			Control (n=38)			*P-value*[c]
	Mean [a]	Median	95%CI [b]	Mean [a]	Median	95%CI [b]	
Vegetables (g)	73	62	58-87	89	62	49-128	0.45
Potatoes (fresh) (g)	37	26	25-48	30	26	21-40	0.37
Fruits/berries(incl juice)(g)	193	158	145-241	209	159	148-270	0.68
Fruits and vegetables [d] (g)	303	270	248-357	328	269	243-412	0.62
Fish (g)	30	24	22-38	22	13	13-30	0.17
Meat (g)	131	127	116-147	113	103	89-137	0.20
Sugar/sweets (g)	31	23	22-40	44	41	34-55	0.05[e]
Soft drinks w/sugar (g) [f]	290	250	224-357	248	225	178-318	0.38
Carbonated soft drinks (g)	195	125	141-248	159	161	110-208	0.33
Diet soft drinks (g)	178	58	107-248	162	0	75-248	0.78
Diet carb. soft drinks (g)	106	0	65-147	85	0	39-130	0.48
Water (for drinking) (g)	501	383	400-602	522	370	325-720	0.85
Pizza (g)	55	0	31-79	75	48	44-107	0.30
Snacks (g)	13	3	8-19	9	4	5-13	0.24
Dark bread (g)	22	0	12-31	17	0	9-25	0.45
White bread (g)	41	34	31-51	39	35	26-52	0.82
Milk/yoghurt (g)	342	298	281-403	380	362	318-441	0.38

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval, [c] Two-sample t-test, [d] includes vegetables, potatoes (fresh), fruits, berries and fruit juices, [e] $p \leq 0.05$, [f] includes sugar sweetened carbonated soft drinks and other sugar sweetened soft drinks (diet soft drinks are artificially sweetened soft drinks), i.e. lemonade and iced tea

The intake of sugar/sweets is significantly higher in healthy boys compared to boys with history of asthma, p=0.05, table 4.1.

Table 4.2 Daily intake of selected food items in 13 yrs old girls with history of asthma and control subjects

	Case (n=28)			Control (n=38)			*P-value*[c]
	Mean[a]	Median	95%CI[b]	Mean[a]	Median	95%CI[b]	
Vegetables (g)	65	48	40-89	86	77	63-109	0.20
Potatoes (fresh) (g)	36	19	19-52	36	35	23-49	0.98
Fruits/berries (incl juice) (g)	183	134	129-237	227	166	159-295	0.31
Fruits and vegetables[d] (g)	283	254	219-348	349	301	272-425	0.19
Fish (g)	14	0	6-22	20	8	12-28	0.25
Meat (g)	101	74	66-136	103	86	83-122	0.94
Sugar/sweets (g)	43	37	26-60	30	26	23-37	0.17
Soft drinks with sugar (g)[e]	225	154	145-305	151	125	105-197	0.11
Diet soft drinks (g)	134	19	39-230	64	0	25-103	0.17
Carbonated soft drinks (g)	145	120	84-206	91	75	59-122	0.11
Diet carb. soft drinks (g)	106	0	27-185	49	0	18-80	0.18
Water (for drinking) (g)	594	499	393-795	420	350	312-528	0.13
Pizza (g)	35	0	10-59	37	0	19-55	0.87
Snacks (g)	4	0	1-8	4	1	2-6	0.90
Dark bread (g)	13	0	5-22	25	0	12-38	0.14
White bread (g)	29	25	18-39	36	25	24-47	0.35
Milk/yoghurt (g)	255	203	165-346	299	262	242-355	0.41

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval, [c] Two-sample t-test, [d] includes vegetables, potatoes (fresh), fruits, berries and fruit juices, [e] includes sugar sweetened carbonated soft drinks and other sugar sweetened soft drinks (diet soft drinks are artificially sweetened soft drinks), i.e. lemonade and iced tea

There are no significant differences between girls with a history of asthma and healthy controls, table 4.2.

4.2 Energy and nutrient intake

Intake of energy and nutrients among asthmatic subjects (both genders) and controls are presented in table 5.1, 5.2, 6.1, 6.2, 7.1, 7.2 and 8.1, 8.2. Some kinds of supplements (vitamin and/or mineral supplement) were used by 46.5 % of the participants. Regarding energy intake, the differences between asthmatic girls and boys and control subjects were rather small (NS), table 5.1, 5.2, 6.1, 6.2. For all groups the energy intake is lower than the reference values in the NNR for adolescents in the same age. The estimated energy requirements for 13 years old girls (per day) is 9.1 MJ, and for boys 10.2 MJ (62). (This is based on age-related average weight and moderate physical activity).

All groups had a higher percentage of energy (E%) from saturated fat than recommended in the NNR while the E% of polyunsaturated fat was in the lower level of the recommended range. All groups had an E% of added sugars above the recommended intake. Girls with a history of asthma had a significantly higher intake of added sugars ($p=0.01$), (table 6.2) than their healthy controls. The trend was opposite in asthmatic boys, the energy percentage (E%) of added sugars being higher in the control group ($p=0.05$), (table 6.1). The intake of fibre was lower than recommended for all adolescents. Mean intakes of micronutrients, apart from vitamin D, calcium and magnesium, compares well with current recommendations. In those with current asthma and in the control group, there was also a lower intake of folate and iron than recommended. These intakes were lowest (folate: 164 µg, iron:9,1 mg) for girls with current asthma, table 7.2.

Neither asthmatics, (both genders), nor the healthy controls reached the recommended level for fibre, and the E% for carbohydrate was in the lower level of the recommended range (table 5.1, 5.2, 6.1, 6.2). They all had a E% from added sugars and saturated fat above the recommended level, and the E% of

polyunsaturated fat is in the lower level of the recommended range. The E% from fat (total) is in the higher level of the recommended range. Mean intakes of retinol, α-Tokoferol, riboflavin and vitamin C compares well with current recommendations (RI), table 7.1, 7.2 and 8.1, 8.2. The mean intake of vitamin D is low for all groups except for girls with current asthma, while the intake of thiamin is unsatisfactory for the same group (compared with RI). Thiamin intake compares well with current recommendations (RI) for the other asthmatic adolescents. In those with current asthma, in girls with history of asthma and in adolescents in the control group (except iron intake for boys in the control group), there was a lower intake of folate and iron than recommended (compared with RI). For girls with current asthma, these intakes were particularly low (NS) (table 7.2). The intake of magnesium is only satisfactory for boys with current asthma or history of asthma, table 7.1 and 8.1 (compared with RI).

Table 5.1 Daily intake of energy and nutrients in 13 yrs old boys with current asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=40)			Control (n=38)			P-value[c]	NNR[d]
	Mean[a]	Median	95%CI[b]	Mean[a]	Median	95%CI[b]		
Energy (MJ)	8.9	8.2	8.0-9.8	9.0	8.9	8.2-9.7	0.93	
Protein (E%)	15.8	15.5	15.0-16.7	15.2	15.4	14.5-15.2	0.29	15 (10-20)[e]
Fat (E%)	32.3	33.8	30.8-33.9	31.2	31.2	29.5-32.9	0.34	30 (25-35)[e]
Saturated fat (E%)	13.9	14.4	13.0-14.8	13.8	14.2	13.0-14.7	0.97	<10
Monounsaturated fat (E%)	10.9	11.0	10.2-11.6	10.3	10.6	9.6-10.9	0.22	10-15
Polyunsaturated fat (E%)	5.3	4.9	4.9-5.7	4.9	5.0	4.4-5.3	0.17	5-10
Carboydrate (E%)	51.9	51.4	50.3-53.4	53.5	53.1	51.5-55.5	0.20	55 (50-60)[e]
Added sugars (E%)	12.9	13.6	10.9-14.8	14.8	8.9	13.3-16.4	0.12	≤ 10
Fibre (g)	17.3	13.8	12.8-21.7	17.1	14.6	14.0-20.2	0.94	25-35

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] Acceptable intake range for the nutrient

Table 5.2 Daily intake of energy and nutrients in 13 yrs old girls with current asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=11)			Control (n=38)			P-value[c]	NNR[d]
	Mean[a]	Median	95%CI[b]	Mean[a]	Median	95%CI[b]		
Energy (MJ)	7.6	6.7	6.4-8.9	7.7	7.7	7.2-8.2	0.87	
Protein (E%)	14.3	14.5	12.7-15.8	15.4	15.2	14.7-16.1	0.16	15 (10-20)[e]
Fat (E%)	31.9	32.9	29.4-34.5	31.9	31.4	30.3-33.5	0.98	30 (25-35)[e]
Saturated fat (E%)	13.7	13.7	11.8-15.6	14.0	14.0	13.2-14.8	0.80	<10
Monounsaturated fat (E%)	10.4	10.4	9.5-11.3	10.2	10.1	9.6-10.9	0.77	10-15
Polyunsaturated fat (E%)	5.4	5.6	4.8-6.0	5.3	5.1	4.9-5.7	0.66	5-10
Carboydrate (E%)	53.7	54.3	50.0-57.5	52.7	52.4	51.0-54.4	0.60	55 (50-60)[e]
Added sugars (E%)	16.7	17.2	12.4-21.1	12.6	12.3	11.2-14.1	0.07	≤ 10
Fibre (g)	14.7	14.1	8.6-20.8	15.7	15.0	13.7-17.8	0.72	25-35

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] Acceptable intake range for the nutrient

Table 6.1 Daily intake of energy and nutrients in 13 yrs old boys with history of asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=65)			Control (n=38)			P-value[c]	NNR[d]
	Mean[a]	Median	95%CI[b]	Mean[a]	Median	95%CI[b]		
Energy (MJ)	9.0	8.5	8.4-9.7	9.0	8.9	8.2-9.7	0.87	
Protein (E%)	16.2	16.2	15.5-16.8	15.2	15.4	14.5-16.0	0.07	15 (10-20)[e]
Fat (E%)	32.6	33.6	31.4-33.8	31.2	31.2	29.5-32.9	0.20	30 (25-35)[e]
Saturated fat (E%)	14.0	14.3	13.4-14.6	13.8	14.2	13.0-14.7	0.80	<10
Monounsaturated fat (E%)	10.8	10.6	10.3-11.4	10.3	10.6	9.6-10.9	0.19	10-15
Polyunsaturated fat (E%)	5.4	5.1	5.1-5.8	4.9	5.0	4.4-5.3	0.07	5-10
Carboydrate (E%)	51.3	51.1	49.9-52.6	53.5	53.1	51.5-55.5	0.06	55 (50-60)[e]
Added sugars (E%)	12.6	13.3	11.0-14.2	14.8	15.0	13.3-16.4	0.05[f]	≤ 10
Fibre (g)	17.0	14.3	14.1-19.8	17.1	14.6	14.0-20.2	0.95	25-35

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] Acceptable intake range for the nutrient, [f] $p \leq 0.05$

Table 6.2 Daily intake of energy and nutrients in 13 yrs old girls with history of asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=28)			Control (n=38)			P-value[c]	NNR[d]
	Mean[a]	Median	95%CI[b]	Mean[a]	Median	95%CI[b]		
Energy (MJ)	7.6	7.0	6.6-8.5	7.7	7.7	7.2-8.2	0.82	
Protein (E%)	14.3	14.5	13.2-15.3	14.3	15.2	13.2-15.3	0.06	15 (10-20)[e]
Fat (E%)	31.4	31.0	29.6-33.2	31.9	31.4	30.3-33.5	0.69	30 (25-35)[e]
Saturated fat (E%)	14.0	13.8	13.1-14.9	14.0	14.0	13.2-14.8	0.99	<10
Monounsaturated fat (E%)	10.1	10.0	9.3-10.9	10.2	10.1	9.6-10.9	0.75	10-15
Polyunsaturated fat (E%)	5.1	5.1	4.6-5.7	5.3	5.1	4.9-5.7	0.63	5-10
Carboydrate (E%)	54.2	55.0	52.0-56.4	52.7	52.4	51.0-54.4	0.26	55 (50-60)[e]
Added sugars (E%)	16.5	16.4	13.9-19.0	12.6	12.3	11.2-14.1	0.01[f]	≤ 10
Fibre (g)	13.8	13.2	11.2-16.4	15.7	15.0	13.7-17.8	0.23	25-35

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] Acceptable intake range for the nutrient, [f] $p \leq 0.05$

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Table 7.1 Daily intake of nutrients in 13 yrs old boys with current asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=40)			Control (n=38)			P-value[c]	NNR[d] RI[e]
	Mean [a]	Median	CI[b]	Mean [a]	Median	CI[b]		
Retinol eq (µg)	998	864	798-1,197	1,075	1,039	883-1,267	0.57	600
α-Tokoferol (µg)	8.9	7.7	7.3-10.4	8.8	8.7	7.5-10.2	0.10	7 (8) [f]
Vitamin D (µg)	4.5	3.4	3.2-5.8	4.1	3.0	3.0-5.3	0.67	7.5
Thiamin (mg)	1.2	1.1	1.0-1.4	1.2	1.1	1.0-1.3	0.68	1.0(1.2)[f]
Riboflavin (mg)	1.5	1.4	1.3-1.7	1.5	1.5	1.4-1.7	0.84	1.2(1.4)[f]
Folate (µg)	194	160	165-223	192	183	173-212	0.94	200
Vitamin C (mg)	95	77	71-119	91	93	76-106	0.76	50
Calcium (mg)	870	749	727-1,012	952	885	848-1,055	0.35	900
Iron (mg)	10.8	9.2	9.0-12.5	11.1	9.9	9.6-12.6	0.75	11
Magnesium (mg)	283	245	239-327	279	256	245-312	0.88	280

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] RI = Recommended intake , [f] Values for boys/men in paranthesis

Table 7.2 Daily intake of nutrients in 13 yrs old girls with current asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=11)			Control (n=38)			P-value[c]	NNR[d] RI[e]
	Mean[a]	Median	CI[b]	Mean[a]	Median	CI[b]		
Retinol eq (µg)	1,086	790	415-1,757	1,230	985.5	1,012-1,449	0.66	600
α-Tokoferol (µg)	10.3	9.1	5.8-14.8	10.2	8.5	8.5-11.9	0.98	7 (8)[f]
Vitamin D (µg)	7.5	4.2	1.4-13.7	5.9	3.9	4.2-7.5	0.58	7.5
Thiamin (mg)	0.9	0.7	0.7-1.2	1.2	1.0	1.0-1.4	0.08	1.0(1.2)[f]
Riboflavin (mg)	1.3	0.9	0.8-1.7	1.5	1.4	1.3-1.8	0.25	1.2(1.4)[f]
Folate (µg)	164	149	116-211	197	173	172-221	0.20	200
Vitamin C (mg)	82	69	44-121	98	83	74-122	0.45	50
Calcium (mg)	818	778	623-1,012	785	748	700-869	0.74	900
Iron (mg)	9.1	8.5	7.4-10.8	10.2	9.9	8.9-11.4	0.28	11
Magnesium (mg)	230	255	179-280	246	236	224-268	0.52	280

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] RI = Recommended intake , [f] Values for boys/men in paranthesis

Table 8.1 Daily intake of nutrients in 13 yrs old boys with history of asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=65)			Control (n=38)			P-value[c]	NNR[d] RI[e]
	Mean[a]	Median	CI[b]	Mean[a]	Median	CI[b]		
Retinol eq (µg)	1,082	863	901-1,263	1,075	1,039	883-1,267	0.96	600
α-Tokoferol (µg)	9.9	7.8	8.4-11.5	8.8	8.7	7.5-10.2	0.29	7 (8)[f]
Vitamin D (µg)	5.0	3.8	3.8-6.1	4.1	3.0	3.0-5.3	0.30	7.5
Thiamin (mg)	1.3	1.1	1.1-1.5	1.2	1.1	1.0-1.3	0.19	1.0(1.2)[f]
Riboflavin (mg)	1.7	1.4	1.5-1.9	1.5	1.5	1.4-1.7	0.27	1.2(1.4)[f]
Folate (µg)	211	168	181-241	192	183	173-212	0.31	200
Vitamin C (mg)	97	76	80-115	91	93	76-106	0.57	50
Calcium (mg)	944	836	826-1,061	952	885	848-1,055	0.92	900
Iron (mg)	12.1	9.8	10.2-13.9	11.1	9.9	9.6-12.6	0.43	11
Magnesium (mg)	281	246	251-310	279	256	245-312	0.94	280

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] RI = Recommended intake , [f] Values for boys/men in paranthesis

Table 8.2 Intake of nutrients in 13 yrs old girls with history of asthma and control subjects in comparison with Nordic Nutrition Recommendations (NNR)

	Case (n=28)			Control (n=38)			P-value[c]	NNR[d] RI[e]
	Mean[a]	Median	CI[b]	Mean[a]	Median	CI[b]		
Retinol eq (µg)	1,064	782	726-1,402	1,230	986	1,012-1,449	0.40	600
α-Tokoferol (µg)	9.6	7.3	6.9-12.3	10.2	8.5	8.5-11.9	0.69	7 (8)[f]
Vitamin D (µg)	5.5	3.5	2.9-8.1	5.9	3.9	4.2-7.5	0.80	7.5
Thiamin (mg)	1.2	1.0	0.9-1.5	1.2	1.0	1.0-1.4	0.84	1.0(1.2)[f]
Riboflavin (mg)	1.5	1.2	1.1-1.8	1.5	1.4	1.3-1.8	0.83	1.2(1.4)[f]
Folate (µg)	180	156	148-213	197	173	172-221	0.42	200
Vitamin C (mg)	96	92	74-119	98	83	74-122	0.93	50
Calcium (mg)	785	748	700-869	727	701.0	613-841	0.41	900
Iron (mg)	9.7	8.7	8.0-11.4	10.2	9.9	8.9-11.4	0.63	11
Magnesium (mg)	225	206	197-253	246	236	224-268	0.23	280

[a] Mean of 95% Confidence Interval, [b] 95% Confidence Interval , [c] Two-sample t-test, [d] Nordic Nutrition Recommendations 2004, [e] RI = Recommended intake , [f] Values for boys/men in paranthesis

4.3 Underestimation

BMR factor (Energy intake/BMR estimated) was calculated to assess the frequency of underestimation among the adolescents in the present study. The asthmatic boys seem to underreport to a larger degree, but also in girls with history of asthma the percentage of underreporting is rather high, 25 %, table 9.1 and 9.2.

Table 9.1 Estimated BMR (BMR_{est}). BMR factor (Energy intake/BMR_{est}) and percentage underestimating their energy intake (EI) for adolescents with current asthma and control subjects

	Boys case n=40 mean	**Boys control n=38 mean**	**Girls case n=11 mean**	**Girls control n=38 mean**
Estimated BMR[a] (MJ) (kcal)	6.6 (1571)	6.6 (1571)	5.7 (1357)	5.7 (1357)
BMR factor (EI/BMRest)	1.4	1.4	1.3	1.4
Percentage underestimating their energy intake (n)[b]	22.5% (9)	18.4% (7)	18.2% (2)	18.4% (7)

[a] Using equations for predicting BMR from weight (kg) and height (m). 1985 FAO/WHO/UNU report and the Commission of the European Communities, 1992 (Nordic Nutrition Recommendation 2004)

[b] Using Goldberg's cut- off values for underestimation. BMR factor < 1.06 (Goldberg et al 1991)

Table 9.2 Estimated BMR (BMR_{est}). BMR factor (Energy intake/BMR_{est}) and percentage underestimating their energy intake (EI) for adolescents with history of asthma and control subjects

	Boys case n=65 mean	**Boys control n=38 mean**	**Girls case n=28 mean**	**Girls control n=38 mean**
Estimated BMR[a] (MJ) (kcal)	6.8 (1619)	6.6 (1571)	5.8 (1381)	5.7 (1357)
BMR factor (EI/BMRest)	1.3	1.4	1.3	1.4
Percentage underestimating their energy intake (n) [b]	23.1% (15)	18.4% (7)	25.0% (7)	18.4% (7)

[a] Using equations for predicting BMR from weight (kg) and height (m). 1985 FAO/WHO/UNU report and the Commission of the European Communities, 1992 (Nordic Nutrition Recommendation 2004).

[b] Using Goldberg's cut- off values for underestimation. BMR factor < 1.06 (Goldberg et al 1991)

5. Discussion

In the present study, we found a higher intake of sugar-containing soft drinks in asthmatic adolescents, and a higher intake of snacks in those with current asthma compared to healthy controls. Most of the adolescents had a lower intake of fruits and vegetables, fibre, vitamin D, calcium and magnesium than recommended. The E% of saturated fat and added sugars was above the recommended level for all adolescents. The percentage of overweight was higher in both asthmatic groups compared to the control group though statistically not significant. In the present study girls with a history of asthma had a significantly higher E% of added sugars compared to healthy girls and girls with current asthma had lowest intakes of folate and iron. For boys the E% of added sugars was higher in healthy boys compared to boys with asthma ($p=0.05$).

For comparison of the intake of energy and nutrients with current recommendations, the NNR (62) (and not the Norwegian nutrient recommendations) was used, since these recommendations are in English, and the intention is to publish the enclosed article. Both those with asthma and the healthy population are recommended to follow the NNR.

The Norwegian nutrient recommendations are based upon the NNR (and are also very similar to the NNR). For some groups of women the recommended intake of folate differs, and values for limiting the intake of trans fatty acids and salt are included in the Norwegian nutrient recommendations.

The values for recommended intake (RI) of vitamins and minerals, table 7 and 8, are mainly intended to be used for planning diets for groups of healthy individuals. It is important to be aware that the recommended intake represents more than the requirement for the average person. RI covers the individual variations in the requirement for the majority of the population group. Average requirement (AR) is used to define the intake of nutrients (vitamins and minerals) that represents the

average requirement for a defined group of individuals. These values are only intended for evaluating results from dietary surveys. At present there are only average requirements for adults, and therefore RI of these nutrients for 13 years old boys and girls are used as reference values in the present study (table 7 and 8).

For Norwegian children/adolescents there are no official recommendations for fruits and vegetables, but 500 g/day has been suggested as an appropriate amount (67) ; 200 g from fruit (included juice) a day and 300 g vegetables (included potato). This level is based on the Danish recommendations where 400 g fruits and vegetables (excluded potato) is recommended for children in the age 4-10 years old.

For both genders the energy intake is lower than the reference values suggested in NNR. The girls have a greater difference between the energy intake and the reference value than boys. The estimated energy requirements for 13 years old girls (per day) is 9.1 MJ, and for boys 10.2 MJ (62). Underestimation of the energy intake may partly explain the discrepancy between the energy intake and the reference values. A couple of studies in asthmatic children have also shown decreased physical activity compared to healthy controls (44;45), which might reduce the energy requirement in asthmatics. However, no significant differences between the energy intake in asthmatic and control subjects were seen in the present study. There were neither any difference between the genders. As there are few dietary studies estimating the energy intake of asthmatic adolescents, this limits the possibility to compare the present results with other results. Murray et al found no differences in mean energy intake when comparing sensitized children with recurrent wheeze to healthy controls (68).

The E% of added sugars was above the recommended level for all adolescents. Sugar-containing soft drinks is one of the major sources of added sugars (69), and the intake of these drinks was significantly higher in asthmatics. An excessive sugar intake may contribute to obesity (70), which is more closely discussed in the article. For females becoming overweight or obese between 6 and 11 years the risk of developing new asthma symptoms during early adolescent period increases (51).

Overweight or obesity in asthmatics worsen the disease (71), and weight loss improves asthma outcomes (52). There are several proposed mechanisms by which obesity affects airway function (72) (described in the enclosed article).
Øverby et al showed a negative association between a high intake of added sugar and the intake of fruits, vegetables and micronutrients (73). In the present study girls with a history of asthma had a significantly higher E% of added sugars compared to healthy girls. Girls with current asthma are included in the group above (history of asthma) and had the lowest intakes of folate and iron. For boys it is interesting that the E% of added sugars is higher in the control group ($p=0.05$). Compared to boys with current asthma or history of asthma, the intake of sugar/sweets was significantly higher for healthy boys.

The dietary recommendations in Norway urge to increase the intake of complex carbohydrates and fibre, to reduce the intake of added sugars and the intake of fat, especially saturated fat. These recommendations are based on thorough research, and they are valid for asthmatics as well as healthy subjects (74). Results from the present study show that there is a potential of improvement concerning the diet for all boys and girls involved. All groups had a higher intake of saturated fat and added sugars than recommended by the NNR, while the intake of fruits and vegetables and fibre was lower than recommended. Several studies indicate that asthmatics, especially by increasing their intake of fruits and vegetables, may experience improved lung function (36;38;39;75;76) since these foods contribute with several positive dietary factors. For those with current asthma the mean daily intake of fruits and vegetables was 312 g/day while those with history of asthma had a mean daily intake of 300 g/day. (The mean daily intake in the control group was 343 g/day.) The current recommendation concerning fruits and vegetables is “5 a day” which is calculated to be 500 g/day (increases to 750 g/day in adults) (67). Potato (fresh, i.e. baked or boiled) and juice is included in this amount (in addition to fruits, vegetables and berries), showing there are several choices within this food group to increase the daily intake.

Differences between groups were analysed by a two-sample t-test. We performed no adjustment for multiple testing which it is important to be aware about. For the present study we had planned to include a larger number adolescents. Unfortunately we did not succeed in that. The number of girls with asthma is low, especially the number of girls with current asthma (n=11). Studies demonstrate more frequent allergic sensitization and asthma in boys than girls (20-22), which may explain this imbalance. The enclosed article discusses the cohort more closely.

There is also a low number overweight or obese, limiting the use of the dietary data for these groups separately. It might although seem as those who are overweight or obese have a more unhealthy diet compared to the adolescents with normal weight, described in the enclosed article. The Cochrane review "Calorie controlled diet for chronic asthma" (55) identified 13 articles for possible inclusion, but only one trial met the inclusion criteria. The trial included two groups of 19 obese adults. After a 14 week weight reduction programme, lung function, symptoms, morbidity and health status was significantly improved in the intervention group compared to the controls (52). Prevention and treatment of overweight in asthmatic adolescents is therefore recommended. By following the NNR this is easier accomplished (62).

The method used in the present study was by the adolescents perceived as a convenient method. They found it simple to register their data, and they hardly ever had questions concerning the dietary recording. By using this method an in-depth analysis of food intake is accomplished, and it allows a computation of daily intakes of foods, energy and nutrients. Dietary registration methods like 24 hour recall or food frequency questionnaires yield more limited dietary data compared to a four day recording using food diaries. Another advantage of using precoded food diaries is that it is less time-consuming compared with other methods, i e weighed records and dietary history. Experience has also shown a lower completion rate using weighed records for 7 days. Of the 175 adolescents included in the present study, 169 completed the food diaries (96.6%).

The method used in the present study has been validated in 13 years old adolescents, and the energy intake was found to be underestimated by 34% and 24% (two separate validation studies) compared with energy expenditure measured by the activity monitor Acti Reg®. The underestimation in the present study is discussed in the enclosed article (77).

Using the present method, the results can only describe the mean intake of groups. However four days may not give a good measure of the habitual intake at the individual level. The aim is often to compare the mean intake in various groups. As some of the groups in the present study are small, i e when comparing gender differences, the representativity weakens. Other factors that must be taken into account are the foods and nutrients of interest. I.e, to receive a good mean energy intake, approximately 50 persons should be included. The composition of the group is also of importance, i e if it is homogeneous or not (78).

As the present study is a case-control study, the results can be used to describe these asthmatic adolescents and their controls and to identify factors associated with asthma. This can be done since this cohort is representative (more closely discussed in the enclosed article), but further research is recommended to investigate these associations more closely.

Awareness about the less healthy diet among the asthmatic compared to healthy adolescents must be taken into account. A high sugar intake may give a lower intake of micronutrients and increase body weight (69;79;80). Asthmatic adolescents might benefit by experiencing improved lung function by following a diet supplying vitamins and antioxidants (i.e. as a result of an increased intake of fruits and vegetables) (36;38;39;75;76). In addition, a diet in accordance to the dietary recommendations, to a larger degree will prevent overweight, which also is shown to be beneficial for asthmatics (52). As girls with asthma have a significantly higher sugar intake, gender differences should be investigated more closely. Awareness about this is also important since the risk of developing new asthma symptoms during early adolescent years is increased for girls compared to boys (51).

Results from the present study show that there is a potential of improving the diet for all girls and boys included.

6. Conclusion I

6.1 Objectives of the study and results

The overall objective of the study was:

Will those with asthma have a different composition of their diet compared to healthy adolescents? More precisely:

i) Is the intake of energy yielding nutrients such as fat and sugar higher in those with asthma compared to the controls?

The energy percentage (E%) of fat and added sugars is alike among adolescents with asthma and healthy adolescents. The E% of added sugar and saturated fat is higher than the recommended levels in NNR, both for the asthmatic and the healthy adolescents.

ii) Is the intake of sugar containing soft drinks and sweets higher in those with asthma compared to the healthy adolescents?

The intake of sugar-containing soft drinks is significantly higher in adolescents with asthma (current asthma and history of asthma) compared to the healthy controls, while there are insignificant differences in the intake of sweets.

iii) Is the intake of fruits/berries (including fruit juices), vegetables and potatoes lower in the asthmatic adolescents compared to the controls?

The intake is low both in asthmatic and control subjects compared to the recommended daily intake (500 g/day). There is a lower intake, although not significantly lower, among the asthmatic adolescents compared to the healthy adolescents

iv) Is the intake of vitamin C (included vitamin C from supplements) lower in those with asthma compared to the healthy controls?

The intake of vitamin C is alike in the healthy adolescents and in the asthmatic adolescents.

Further, secondary aims were to compare adolescents with asthma and age-matched healthy controls with respect to:

v) Is the intake of micro-and macronutrients in the adolescents (asthmatic and healthy) satisfactory or unsatisfactory in consideration to the Nordic Nutrient Recommendations?

All groups had a higher percentage of energy (E%) from saturated fat than recommended in the NNR. The E% of polyunsaturated fat was in the lower level of the recommended range, and the E% of fat (total) in the upper level of the recommended intake range. All groups had a E% of added sugar above the recommended intake. The intake of fibre was also lower than recommended for all adolescents, and the E% of carbohydrate in the lower level of the recommended range. Mean intakes of micronutrients, apart from vitamin D, calcium and magnesium, were above RI (i.e. mean intake of thiamine in those with current asthma is 0.1 mg under the recommended intake for girls). In those with current asthma and in the control group, there was in addition a lower intake of folate and iron than recommended.

Also,

vi) Is there a higher percentage of overweight in adolescents with asthma compared to healthy adolescents, and if so; is the diet in overweight asthmatics in any way characteristic?

The percentage of overweight (including those obese) was 19,3% in adolescents with asthma; 21.4% (n=9) in those having a history of asthma (excluding those with current asthma) and 17.6% (n=9, 1 of these obese) in those having current asthma,

compared to 11.8% (n=9, 3 of these obese) in the control group. The differences are not statistically significant.

There is a low number overweight or obese, limiting the use of the dietary data for these groups, i.e. not allowing statistical analysis. The results can indicate a less healthy diet in the overweight asthmatics: the mean energy intake in the overweight asthmatics is lower compared to the mean intake of normal weight asthmatics (either with current asthma or history of asthma), and the mean intake of fat, sugar and sugar-containing soft drinks is higher compared to normal weight asthmatics. Intake of fruits and vegetables and vitamin C is lower in asthmatic overweight boys compared to asthmatic boys who are normal weight (either with history of asthma or current asthma). The intake of vitamin C is still above the recommended level. The overweight girls had a similar intake of fruits and vegetables compared to the normal weight girls.

Finally, comparing adolescents with asthma and age-matched healthy controls:

viii) Are there differences between the genders concerning composition of the diet or intake of micro- and macronutrients?

Girls with history of asthma have a significantly higher E% of “added sugars” than healthy girls. For boys with history of asthma the E% of “added sugars” was significantly lower (p=0.05) compared to the healthy controls. The asthmatic boys (both history of asthma and current asthma) also have a significantly lower intake of sugar and sweets than their healthy controls (p=0.05). The intake of dark bread is significantly lower for girls with current asthma compared to their healthy controls, p=0.03.

7. Conclusion II

In conclusion, the present study shows that the mean intake of sugar-containing soft drinks is significantly higher in asthmatic adolescents than in healthy adolescents. The mean intake of snacks is also significantly higher in those with current asthma. The asthmatic girls (history of asthma) had a significantly higher E% of "added sugars" (mean) compared to their healthy controls. The asthmatic boys had a significantly lower intake of "added sugars" than their healthy controls. After 10 years of age, more girls than boys acquire asthma, and overweight is a risk factor in girls. There is a demand for additional dietary research in children and adolescents with asthma, also examining gender differences.

The results support, though not statistically significant, other studies showing a higher prevalence of overweight in asthmatics. All groups had a higher mean intake of saturated fat and added sugars than recommended, while the mean intake of fruits and vegetables, fibre, vitamin D, calcium and magnesium was mostly lower than the recommendations. The mean intake of fat (total) was in the upper level of the recommended range, while the mean intake of carbohydrate was in the lower level of the recommended range. The present study suggests that there is a potential of improvement of the diet for all girls and boys included.

References

(1) British guideline on the management of asthma. Thorax 2003 Feb;58 Suppl 1:i1-94.

(2) International consensus report on diagnosis and treatment of asthma. National Heart, Lung, and Blood Institute, National Institutes of Health. Bethesda, Maryland 20892. Publication no. 92-3091, March 1992. Eur Respir J 1992 May;5(5):601-41.

(3) Johansson SG, Hourihane JO, Bousquet J, Bruijnzeel-Koomen C, Dreborg S, Haahtela T, et al. A revised nomenclature for allergy. An EAACI position statement from the EAACI nomenclature task force. Allergy 2001 Sep;56(9):813-24.

(4) Lodrup Carlsen KC, Haland G, Devulapalli CS, Munthe-Kaas M, Pettersen M, Granum B, et al. Asthma in every fifth child in Oslo, Norway: a 10-year follow up of a birth cohort study. Allergy 2006 Apr;61(4):454-60.

(5) Asher MI, Montefort S, Bjorksten B, Lai CK, Strachan DP, Weiland SK, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. Lancet 2006 Aug 26;368(9537):733-43.

(6) Burr ML, Wat D, Evans C, Dunstan FD, Doull IJ. Asthma prevalence in 1973, 1988 and 2003. Thorax 2006 Apr;61(4):296-9.

(7) Braun-Fahrlander C, Gassner M, Grize L, Takken-Sahli K, Neu U, Stricker T, et al. No further increase in asthma, hay fever and atopic sensitisation in adolescents living in Switzerland. Eur Respir J 2004 Mar;23(3):407-13.

(8) von Hertzen L., Haahtela T. Signs of reversing trends in prevalence of asthma. Allergy 2005 Mar;60(3):283-92.

(9) Thomsen SF, Ulrik CS, Larsen K, Backer V. Change in prevalence of asthma in Danish children and adolescents. Ann Allergy Asthma Immunol 2004 May;92(5):506-11.

(10) Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. Lancet 1998 Apr 25;351(9111):1225-32.

(11) Arshad SH. Primary prevention of asthma and allergy. J Allergy Clin Immunol 2005 Jul;116(1):3-14.

(12) Tattersfield AE, Knox AJ, Britton JR, Hall IP. Asthma. Lancet 2002 Oct 26;360(9342):1313-22.

(13) Dahl R, Bjermer L. Nordic consensus report on asthma management. Nordic Asthma Consensus Group. Respir Med 2000 Apr;94(4):299-327.

(14) Wennergren G, Kristjansson S, Strannegard IL. Decrease in hospitalization for treatment of childhood asthma with increased use of antiinflammatory treatment, despite an increase in prevalence of asthma. J Allergy Clin Immunol 1996 Mar;97(3):742-8.

(15) Carlsen KH. Therapeutic strategies for allergic airways diseases. Paediatr Respir Rev 2004 Mar;5(1):45-51.

(16) Maas T, Kaper J, Knottnerus JA, Wesseling G, van SO. Mono and multifaceted allergen reduction interventions for preventing asthma in children at high risk of developing asthma. Maas T , Kaper J , Knottnerus JA , Wesseling G , van Schayck O Mono and multifaceted allergen reduction interventions for preventing asthma in children at high risk of developing asthma Cochrane Database of Systematic Reviews : Protocols 2007 Issue 2 Jo 2007.

(17) Martinez FD. Complexities of the genetics of asthma. Am J Respir Crit Care Med 1997 Oct;156(4 Pt 2):S117-S122.

(18) Ober C, Hoffjan S. Asthma genetics 2006: the long and winding road to gene discovery. Genes Immun 2006 Mar;7(2):95-100.

(19) Zeiger RS, Heller S. Development of nasal basophilic cells and nasal eosinophils from age 4 months through 4 years in children of atopic parents. J Allergy Clin Immunol 1993 Mar;91(3):723-34.

(20) Nicolai T, Pereszlenyiova-Bliznakova L, Illi S, Reinhardt D, von ME. Longitudinal follow-up of the changing gender ratio in asthma from childhood to adulthood: role of delayed manifestation in girls. Pediatr Allergy Immunol 2003 Aug;14(4):280-3.

(21) Johnson CC, Peterson EL, Ownby DR. Gender differences in total and allergen-specific immunoglobulin E (IgE) concentrations in a population-based cohort from birth to age four years. Am J Epidemiol 1998 Jun 15;147(12):1145-52.

(22) Sears MR, Burrows B, Flannery EM, Herbison GP, Holdaway MD. Atopy in childhood. I. Gender and allergen related risks for development of hay fever and asthma. Clin Exp Allergy 1993 Nov;23(11):941-8.

(23) Hesselmar B, Aberg N, Aberg B, Eriksson B, Bjorksten B. Does early exposure to cat or dog protect against later allergy development? Clin Exp Allergy 1999 May;29(5):611-7.

(24) Platts-Mills T, Vaughan J, Squillace S, Woodfolk J, Sporik R. Sensitisation, asthma, and a modified Th2 response in children exposed to cat allergen: a population-based cross-sectional study. Lancet 2001 Mar 10;357(9258):752-6.

(25) Remes ST, Castro-Rodriguez JA, Holberg CJ, Martinez FD, Wright AL. Dog exposure in infancy decreases the subsequent risk of frequent wheeze but not of atopy. J Allergy Clin Immunol 2001 Oct;108(4):509-15.

(26) Gøtzsche PC, Johansen HK, Schmidt LM, Burr ML. House dust mite control measures for asthma. Gøtzsche PC , Johansen HK , Schmidt LM , Burr ML House dust mite control measures for asthma Cochrane Database of Systematic Reviews : Reviews 2004 Issue 4 John Wiley & Sons , Ltd Chichester, UK DOI : 10 1002 /14651858 CD001187 pub2 2004.

(27) Kilburn S, Lasserson TJ, McKean M. Pet allergen control measures for allergic asthma in children and adults. Kilburn S , Lasserson TJ, McKean M Pet allergen control measures for allergic asthma in children and adults Cochrane Database of Systematic Reviews : Reviews 2001 Issue 1 John Wiley & Sons , Ltd Chichester, UK DOI : 10 1002 /14651858 CD002989 2001.

(28) Peroni DG, Piacentini GL, Costella S, Pietrobelli A, Bodini A, Loiacono A, et al. Mite avoidance can reduce air trapping and airway inflammation in allergic asthmatic children. Clin Exp Allergy 2002 Jun;32(6):850-5.

(29) Lodrup Carlsen KC, Jaakkola JJ, Nafstad P, Carlsen KH. In utero exposure to cigarette smoking influences lung function at birth. Eur Respir J 1997 Aug;10(8):1774-9.

(30) Lodrup Carlsen KC, Carlsen KH, Nafstad P, Bakketeig L. Perinatal risk factors for recurrent wheeze in early life. Pediatr Allergy Immunol 1999 May;10(2):89-95.

(31) Stick SM, Burton PR, Gurrin L, Sly PD, LeSouef PN. Effects of maternal smoking during pregnancy and a family history of asthma on respiratory function in newborn infants. Lancet 1996 Oct 19;348(9034):1060-4.

(32) Barbee RA, Murphy S. The natural history of asthma. J Allergy Clin Immunol 1998 Oct;102(4 Pt 2):S65-S72.

(33) Carlsen KH, Orstavik I, Leegaard J, Hoeg H. Respiratory virus infections and aeroallergens in acute bronchial asthma. Arch Dis Child 1984 Apr;59(4):310-5.

(34) Strachan DP. Family size, infection and atopy: the first decade of the "hygiene hypothesis". Thorax 2000 Aug;55 Suppl 1:S2-10.

(35) Asher I. Is hygiene damaging to your health? Paediatr Respir Rev 2006;7 Suppl 1:S110-S111.

(36) Devereux G, Seaton A. Diet as a risk factor for atopy and asthma. J Allergy Clin Immunol 2005 Jun;115(6):1109-17.

(37) Cook DG, Carey IM, Whincup PH, Papacosta O, Chirico S, Bruckdorfer KR, et al. Effect of fresh fruit consumption on lung function and wheeze in children. Thorax 1997 Jul;52(7):628-33.

(38) Forastiere F, Pistelli R, Sestini P, Fortes C, Renzoni E, Rusconi F, et al. Consumption of fresh fruit rich in vitamin C and wheezing symptoms in children. SIDRIA Collaborative Group, Italy (Italian Studies on Respiratory Disorders in Children and the Environment). Thorax 2000 Apr;55(4):283-8.

(39) Gilliland FD, Berhane KT, Li YF, Gauderman WJ, McConnell R, Peters J. Children's lung function and antioxidant vitamin, fruit, juice, and vegetable intake. Am J Epidemiol 2003 Sep 15;158(6):576-84.

(40) Hijazi N, Abalkhail B, Seaton A. Diet and childhood asthma in a society in transition: a study in urban and rural Saudi Arabia. Thorax 2000 Sep;55(9):775-9.

(41) Rasmussen F, Lambrechtsen J, Siersted HC, Hansen HS, Hansen NC. Low physical fitness in childhood is associated with the development of asthma in young adulthood: the Odense schoolchild study. Eur Respir J 2000 Nov;16(5):866-70.

(42) van GR, van der Ent CK, van Essen-Zandvliet LE, Rovers MM, Kimpen JL, de MG, et al. No differences in physical activity in (un)diagnosed asthma and healthy controls. Pediatr Pulmonol 2007 Nov;42(11):1018-23.

(43) Ownby DR, Peterson EL, Nelson D, Joseph CC, Williams LK, Johnson CC. The relationship of physical activity and percentage of body fat to the risk of asthma in 8- to 10-year-old children. J Asthma 2007 Dec;44(10):885-9.

(44) Lang DM, Butz AM, Duggan AK, Serwint JR. Physical activity in urban school-aged children with asthma. Pediatrics 2004 Apr;113(4):e341-e346.

(45) Firrincieli V, Keller A, Ehrensberger R, Platts-Mills J, Shufflebarger C, Geldmaker B, et al. Decreased physical activity among Head Start children with a history of wheezing: use of an accelerometer to measure activity. Pediatr Pulmonol 2005 Jul;40(1):57-63.

(46) Chinn S. Obesity and asthma: evidence for and against a causal relation. J Asthma 2003 Feb;40(1):1-16.

(47) Bibi H, Shoseyov D, Feigenbaum D, Genis M, Friger M, Peled R, et al. The relationship between asthma and obesity in children: is it real or a case of over diagnosis? J Asthma 2004 Jun;41(4):403-10.

(48) Gold DR, Rotnitzky A, Damokosh AI, Ware JH, Speizer FE, Ferris BG, Jr., et al. Race and gender differences in respiratory illness prevalence and their relationship to environmental exposures in children 7 to 14 years of age. Am Rev Respir Dis 1993 Jul;148(1):10-8.

(49) Oddy WH, Sherriff JL, de Klerk NH, Kendall GE. Breastfeeding, body mass index, and asthma and atopy in children. Adv Exp Med Biol 2004;554:387-90.

(50) Lucas SR, Platts-Mills TA. Paediatric asthma and obesity. Paediatr Respir Rev 2006 Dec;7(4):233-8.

(51) Castro-Rodriguez JA, Holberg CJ, Morgan WJ, Wright AL, Martinez FD. Increased incidence of asthmalike symptoms in girls who become overweight or obese during the school years. Am J Respir Crit Care Med 2001 May;163(6):1344-9.

(52) Stenius-Aarniala B, Poussa T, Kvarnstrom J, Gronlund EL, Ylikahri M, Mustajoki P. Immediate and long term effects of weight reduction in obese people with asthma: randomised controlled study. BMJ 2000 Mar 25;320(7238):827-32.

(53) Kohn M, Booth M. The worldwide epidemic of obesity in adolescents. Adolesc Med 2003 Feb;14(1):1-9.

(54) Andersen LF, Lillegaard IT, Overby N, Lytle L, Klepp KI, Johansson L. Overweight and obesity among Norwegian schoolchildren: changes from 1993 to 2000. Scand J Public Health 2005;33(2):99-106.

(55) Cheng J, Pan T, Ye GH, Liu Q. Calorie controlled diet for chronic asthma. Cheng J , Pan Tao , Ye GH , Liu Q Calorie controlled diet for chronic asthma Cochrane Database of Systematic Reviews : Reviews 2003 Issue 2 John Wiley & Sons , Ltd Chichester, UK DOI : 10 1002 /14651858 CD004674 pub2 2003.

(56) Flaherman V, Rutherford GW. A meta-analysis of the effect of high weight on asthma. Arch Dis Child 2006 Apr;91(4):334-9.

(57) Lodrup Carlsen KC. The environment and childhood asthma (ECA) study in Oslo: ECA-1 and ECA-2. Pediatr Allergy Immunol 2002;13 Suppl 15:29-31.

(58) Haland G, Carlsen KC, Sandvik L, Devulapalli CS, Munthe-Kaas MC, Pettersen M, et al. Reduced lung function at birth and the risk of asthma at 10 years of age. N Engl J Med 2006 Oct 19;355(16):1682-9.

(59) Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000 May 6;320(7244):1240-3.

(60) Fredriks AM, van BS, Fekkes M, Verloove-Vanhorick SP, Wit JM. Are age references for waist circumference, hip circumference and waist-hip ratio in Dutch children useful in clinical practice? Eur J Pediatr 2005 Apr;164(4):216-22.

(61) Rimestad AH Løken EB Nordbotten A. The Norwegian food composition table and the database for nutrient calculations at the Institue for Nutrition Research. Nor J Epidemiol (in Norwegian) 2005;10:7-10.

(62) Nordic Council of Ministers. Nordic nutrition recommendations 2004. Integrating nutrition and physical activity. 4th edn. Norden, Copenhagen, Denmark. 2005.

(63) Commission of the European Communities.Reports of the Scientific Committee for Food. Nutrient and Energy Intakes for the European Community. Thirty-first series of Food Science and Techniques. Luxembourg: Office for Official Publications of the European Communities. 1992.

(64) Schofield WN, Schofield C, James WPT. Basal metabolic rate: review and prediction. Hum Nutr Clin Nutr 1985;39(Suppl 1):1-96.

(65) World Health Organization/Food and Agriculture Organization/United Nations University. Energy and Protein Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. Techical Report Series no. 724. Geneva: WHO. 1985.

(66) Goldberg GR, Black AE, Jebb SA, Cole TJ, Murgatroyd PR, Coward WA, et al. Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording. Eur J Clin Nutr 1991 Dec;45(12):569-81.

(67) Andersen LF, Overby N, Lillegaard IT. [Intake of fruit and vegetables among Norwegian children and adolescents]. Tidsskr Nor Laegeforen 2004 May 20;124(10):1396-8.

(68) Murray CS, Simpson B, Kerry G, Woodcock A, Custovic A. Dietary intake in sensitized children with recurrent wheeze and healthy controls: a nested case-control study. Allergy 2006 Apr;61(4):438-42.

(69) Popkin BM, Nielsen SJ. The sweetening of the world's diet. Obes Res 2003 Nov;11(11):1325-32.

(70) Popkin BM. Dynamics of the nutrition transition and its implications for the developing world. Forum Nutr 2003;56:262-4.

(71) Shore SA. Obesity and asthma: implications for treatment. Curr Opin Pulm Med 2007 Jan;13(1):56-62.

(72) Sood A, Dawson BK, Eid W, Eagleton LE, Henkle JQ, Hopkins-Price P. Obesity is associated with bronchial hyper-responsiveness in women. J Asthma 2005 Dec;42(10):847-52.

(73) Overby NC, Lillegaard IT, Johansson L, Andersen LF. High intake of added sugar among Norwegian children and adolescents. Public Health Nutr 2004 Apr;7(2):285-93.

(74) Sosial- og helsedirektoratet. Retningslinjer for kosthold i helseinstitusjoner. 1995.

(75) Harik-Khan RI, Muller DC, Wise RA. Serum vitamin levels and the risk of asthma in children. Am J Epidemiol 2004 Feb 15;159(4):351-7.

(76) Rubin RN, Navon L, Cassano PA. Relationship of serum antioxidants to asthma prevalence in youth. Am J Respir Crit Care Med 2004 Feb 1;169(3):393-8.

(77) Lillegaard IT, Andersen LF. Validation of a pre-coded food diary with energy expenditure, comparison of under-reporters v. acceptable reporters. Br J Nutr 2005 Dec;94(6):998-1003.

(78) Nordisk Ministerråd. Kostholdsundersøkelser Hvorfor of hvordan? 1987.

(79) Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. Lancet 2001 Feb 17;357(9255):505-8.

(80) Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr 2006 Aug;84(2):274-88.

Article manuscript

Higher intake of sugar-containing soft drinks in adolescents with asthma compared to healthy control subjects.

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Abstract

Aims

Several studies have reported an association between a diet low in fruits, vegetables, vitamin C and overweight and the presence of asthma. The primary aim of the present study was to compare the intake of nutrients and food items in asthmatic and healthy adolescents and secondarily to compare the intake with the Nordic Nutrition Recommendations (NNR). We also wanted to determine the occurrence of overweight in asthmatic compared to healthy adolescents.

Subjects and methods

A total of 169 adolescents (13 years old) were included in the study, 93 with a history of asthma (51 with current asthma) and 76 healthy control subjects. Their entire food intake was registered for four days using a validated 18-page pre-coded food diary.

Results

The intake of sugar-containing soft drinks was significantly higher in adolescents with asthma compared to healthy adolescents, as also was the intake of snacks. All groups had an intake of saturated fat and added sugars exceeding the Nordic Nutrition recommendations, while the intake of fruits and vegetables, fibre, vitamin D, calcium and magnesium was lower than recommended. The intake of vitamin C was adequate for all groups. The prevalence of overweight (including those obese) was 19.3% in adolescents with asthma compared to 11.8% in the control group.

Conclusion

The higher consumption of sugar-containing soft drinks and snacks compared to healthy controls suggest a less healthy diet in asthmatic adolescents. There is a demand for additional dietary research in children and adolescents with asthma, also examining gender differences.

The dietary intake in all girls and boys had a potential for improvement compared to the Nordic Nutrition recommendations.

Introduction

After several decades with an increase of asthma observed in the Western world (1;2), levelling out has been reported in some studies (3). The highest number ever reported in Scandinavia, - a 20.2% lifetime prevalence of asthma among 10-year-old children was recently reported from Oslo (4). Genetic determinants cannot alone account for recent time trends (5). It has been hypothesised that the western modern lifestyle, including a more sedentary behaviour and a dietary change, may contribute to the recent increase in asthma and atopy (5). Several studies have shown a positive association between dietary vitamin C intake or serum ascorbate concentration and lung function or asthma (5-7). It has been suggested that patients with asthma have low supplies of vitamin C or an increased demand for this vitamin (8). A study reporting consumption of fresh fruit rich in vitamin C, and a one year follow up intervention period, showed a beneficial association between fruit intake and respiratory symptoms in children (9), - the effect being stronger in subjects with a history of asthma. A positive association between children's lung function and intake of vitamin A, C and E was also reported (10), showing that wheezing children benefited from fresh fruit consumption. Njå et al reported that daily intake of fruit and vegetables in infancy decreased the risk of asthma in school age children (11). Fruits and vegetables also contain other antioxidants, which are considered to have a positive influence on respiratory symptoms and lung function (5).

Several studies have investigated the possible association between overweight and asthma or asthma-like symptoms (12). The definitions of overweight and obesity in these studies vary as also do the outcomes in being parent-reported symptoms or doctor-diagnosed asthma. Comparing those overweight at baseline to those of normal weight, three studies found a strong association of current asthma to body mass index (BMI) (13-15). These studies were

cross-sectional population surveys adjusting for confounding factors. A number of longitudinal studies have reported increasing risk of developing asthma or asthma symptoms in obese children and adolescents (16). Several mechanisms for the relationship between overweight and asthma have been proposed, including mechanical, immunological, hormonal and inflammatory effects of overweight (17).

A Norwegian dietary study including 4, 9 and 13 years old children, showed a higher intake of added sugars than recommended in the Nordic Nutrition Recommendations (NNR) (18). The high intake of added sugars had a negative influence on the intakes of micronutrients, fruits and vegetables. Soft drinks contributed with the highest proportion of added sugars. The consumption of sugar-containing soft drinks was positively associated with obesity in a 19-month follow-up among 11-12 year old children (19). Worldwide the consumption of added sugars has increased, with sugar-containing soft drinks being a major source (20). Excessive added sugar intake may contribute to obesity and a diet providing less nutrients (20). Studies of adolescents with asthma have so far not concentrated on the intake of added sugars.
The main objective of the present study was to examine the possible differences regarding the intake of nutrients and food items in asthmatic and healthy adolescents, focusing on the intake of vitamin C, fruits and vegetables, soft drinks, sweets and snacks. Secondary aims were to assess the intakes of macro- and micronutrients in relationship to the Nordic Nutrition Recommendations (NNR) (21) and to examine if there is a higher prevalence of overweight in asthmatic adolescents compared to healthy adolescents.

Subjects and methods

Study design

The data collection was carried out from October 2005 to October 2006. An invitation letter was sent to the adolescents and their families by mail. Those who did not respond were contacted by phone. The study was performed in accordance with the Declaration of Helsinki and approved by the Medical Research Ethics Committee and the Data Inspectorate of Norway. Written informed consent to take part was obtained from the participating children and their parents. Spirometry was performed, anthropometric measurements were made and the adolescent and parent(s) were interviewed during one day at the Norwegian School of Sport Sciences. Thereafter, food intake and physical activity was recorded for four days. (Physical activity was recorded by using the metabolic wearable monitor "Sense Wear^{TM} Pro$_2$ Armband" (Body Media Inc., Pittsburgh, PA, USA)). Information about the dietary study and the food diaries were given by a research assistant.

In the present article dietary data and anthropometric data are presented.

Subjects

The adolescents in this study ("Asthma & Lifestyle") were recruited from a birth cohort, "Environment and Childhood Asthma," (ECA), established in Oslo in 1992 (22). The 10 year follow-up study (ECA2) was conducted between September 2001 and July 2004 and included 1019 children (4). The present study "Asthma & Lifestyle" is a nested case-control study from the ECA2 study including a randomized selection of 147 adolescents with asthma and 163 without asthma. The adolescents included as cases should have asthma, and the inclusion criteria are described in detail elsewhere (4). Of the invited adolescents 65% of adolescents with asthma and 49% of the controls participated. Of the 175 adolescents who were included, 169 completed the food diaries (96.6%). Demographic data are given in Table 1. Five did not

complete the food diaries of various reasons, and one was excluded as he did not full fill the inclusion criteria.

Skin prick tests

Skin prick tests to common inhalant and food allergens were performed in "Environment and Childhood Asthma 2" (ECA2), - at the age of 10 (3). Soluprick® allergens (ALK Abello, Denmark) were used, and sensitization considered positive with a wheal diameter ≥ 3 mm larger than the negative control (NaCl) (4). The following allergens were used: Domestic mites *(Dermatophagoides (D.) pteronnysinus* and *D. farinae),* german cockroach, dog, cat and rabbit dander, birch, timothy (grass) and mugwort pollens, mould *(Cladosporium herbarium* and *Alternaria alternata)*, egg white, milk, peanut and codfish.

Anthropometry

Subjects were weighed wearing light clothing and without shoes to the nearest 0.1 kg (Seca 709, Germany). Height was measured to the nearest 0.5 cm by using a stadiometer. BMI (body weight in kilograms/square of height in metres) was calculated for each participant. Overweight and obesity were defined as BMI corresponding to an adult BMI above 25 kg/m^2 and 30 kg/m^2, respectively (23). The BMI cut-off point values for 13 years old boys (21.91 and 26.84 kg/m^2 for overweight and obesity respectively) and girls (22.58 and 27.76 kg/m^2 for overweight and obesity respectively) are used in the present study. A survey of six nationally representative growth studies is the basis for these cut-off points (23). The waist circumference (WC) was measured to midway between the costal arch and the iliac crest. A metal anthropometric tape was used, and WC was measured to the nearest 0.5 cm at the end of a gentle expiration. Age references for WC from Dutch adolescents were used (24). The

suggested WC cut-off points for overweight for 13 year old boys is 75.34 cm and for 13 year old girls 73.58 cm.

Food diary

The entire food intake was registered for four consecutive days, three weekdays and one weekend day. This was done by all participants by using a 18-page pre-coded food diary, described in more details elsewhere (18). An instruction video about how to complete the food diaries was shown. Accompanying the food diaries was also an information folder. The adolescents received a SMS (Short Message Service) reminder the morning the registration started. The dietician in the project phoned them the second evening of the registration period to answer questions and to encourage them to finish the registration. The participants mainly recorded the diet themselves. The diaries were returned by mail. The diary contained lists of 277 drinks, food items and dishes, grouped together according to a typical Norwegian diet (18). Each group is supplemented with open-ended alternatives. The design of the food diary is similar to a cross-table, with food listed on the left and time span on the top. Food amounts are presented in predefined household units or as portions estimated from photographs in a photographic booklet (18). The photographic booklet contains 13 colour photograph series, each with four different portion photographs and was a useful tool for portion size estimates in children and adolescents aged 9-19 years old (25).

Calculations of dietary intake

Data entry was made by scanning, using Teleform 6.0 (Datascan, Oslo, Norway). Daily intake of foods, energy and nutrients was computed using a food database and software system developed at the Department of Nutrition, University of Oslo, Norway (KBS version 4.9). The food database is mainly based on the official Norwegian food composition table (26), and is

continuously supplemented with data on new food items and nutrient contents. Added sugar is refined or industrially produced sugars used as an ingredient in processed or prepared food (18). The use of cod liver oil and vitamin and mineral supplements is included in the nutrient calculation.

Estimation of underreporting of energy intake

A comparison of energy intakes with estimates of basal metabolic rate (BMR), based upon weight, age and sex (21), was used to calculate the number of respondents who underreported their energy intake. Goldberg's cut off values (27) are usually used to evaluate whether reported energy intakes are a plausible measure of the food consumed during an actual measurement period. In the present study the cut off value used is 1.06 (27).

Statistical analysis

Continuous demographic data were presented as mean values with standard deviation (SD) except for age which was given as mean with range. Categorical variables were presented as counts with percentages. Energy intake, nutrient intakes and intakes of selected food groups are presented as mean values with 95% confidence interval (CI). Differences between groups were analysed by a two-sample t-test. We have performed no adjustment for multiple testing. Analysis of variance was performed in order to assess the influence of gender, asthma and overweight on intake of soft drinks with sugar whereas logistic regression analysis was performed to assess the effect of the intake of different food items/energy intake/nutrients and WC and BMI on the risk of developing asthma. We performed three separate logistic regression analyses. In the analysis gender and parental asthma were considered as risk-factors for asthma and were included in the models in addition to the intake of food items/energy intake/nutrients and WC/BMI.

P-values of 0.05 or less were considered statistically significant.

Statistical Package for Social Sciences (SPSS, Chicago, IL, USA) version 14.0 was used in the statistical analysis.

Results

Among the 169 adolescents, (♂/♀103/66) in the present study, 93 (30% ♀) had a history of asthma, 51 (22 % ♀) of these also had current asthma, and 76 had never had asthma (50% ♀), table 1. More than half of the asthmatic boys had one or more positive Skin Prick Tests (SPTs), table 1. A higher number of the asthmatic girls were SPT positive compared to the healthy girls.

Adolescents with asthma had significantly higher intake of sugar-containing soft drinks compared to the control group, p=0.05 for current asthma and p=0.04 for those with a history of asthma, (figure 1). The intake of snacks was also significantly higher for those with current asthma (p=0.04) compared to the healthy controls, (table 2). Boys consumed 79 g more of sugar-containing soft drinks a day than girls (p=0.03). By logistic regression adjusted for gender and parental asthma, no food items/nutrients/energy intake, nor WC or BMI, were found to be associated with asthma (history of asthma or current asthma) in the present study population (data not shown).

Intake of fruits and vegetables (including potatoes, berries and fruit juices) was low compared to the recommended amount (500 g/day) (28), both among asthmatic and control subjects, table 2.

Intakes of energy and nutrients among asthmatic subjects (asthma ever and current asthma) are presented in table 3. Some kind of vitamin and/or mineral supplements were used by 46.5 % of the participants. There were no differences between asthmatic and control subjects regarding energy intake. All groups had a higher percentage of energy (E%) from saturated fat than recommended in the NNR while the E% of polyunsaturated fat was in the lower level of the recommended range. All groups had an E% of added sugars above the recommended intake. Girls with a history of asthma had a significantly higher intake of added sugars

(p=0.01) (data not shown) than their healthy controls. The trend was opposite in asthmatic boys, the energy percentage (E%) of added sugars being higher in the control group (p=0.05 for E% from added sugars in boys with history of asthma) (data not shown). The intake of fibre was lower than recommended for all adolescents. Mean intakes of micronutrients, apart from vitamin D, calcium and magnesium, were covered compared with current recommendations. In those with current asthma and in the control group, there was also a lower mean intake of folate and iron than recommended. The observed intakes were lowest among girls with current asthma (folate: 164 µg, iron:9,1 mg).

Adolescents with a history of asthma had borderline higher WC (74.2 cm, controls: 72.0 cm, p=0.09) and weight (53.3 kg, controls 50.5 kg: p=0.07) compared to the healthy controls, although not statistically significant. Dividing into genders the same tendency is seen (table 1). The percentage of overweight (including those obese) was 19.3% in adolescents with asthma; 21.4% (n=9) in those having a history of asthma (excluding those with current asthma) and 17.6% (n=9, 1 of these obese) in those having current asthma, compared to 11.8% (n=9, 3 of these obese) in the control group (NS). The mean daily intake of fruits and vegetables was approximately 100 g lower/day in asthmatic overweight boys compared to boys who were normal weight. Statistics could not be performed due to the low number overweight/obese. The vitamin C intake in boys was still above the recommended level (data not shown). The overweight girls had a similar intake of fruits and vegetables compared to normal weight girls (data not shown).

The asthmatic boys seem to underreport intake to a larger degree, but also in girls with a history of asthma the percentage of underreporting is rather high, table 4.

Discussion

In the present study, we found a higher intake of sugar-containing soft drinks in asthmatics, and a higher intake of snacks in those with current asthma compared to healthy controls. All groups of adolescents had a lower intake of fruits and vegetables, fibre, vitamin D, calcium and magnesium than recommended. The E% of saturated fat and added sugars was above the recommended level for all adolescents. The percentage of overweight was higher in both asthmatic groups compared to the control group though statistically not significant.
Awareness of the higher intake of sugar containing soft drinks in asthmatic adolescents is important. Drinking 500 ml sugar containing soft drinks a day will result in a 8-10 kg weight gain in one year if physical activity level and energy intake otherwise is stable (29). A systematic review of 30 publications by Malik et al (30), showed that a greater consumption of sugar-containing soft drinks is associated with weight gain and obesity.
Øverby et al showed a negative association between a high intake of added sugar and the intake of fruits and vegetables and micronutrients (18). In the present study girls with a history of asthma had a significantly higher E% of added sugars compared to healthy girls and girls with current asthma had low intakes of folate and iron. An excessive sugar intake may contribute to obesity (31). Overweight or obesity in persons with asthma worsen the disease (32), and an intervention study showed significantly improvement after weight reduction in adults with asthma (33). There are several proposed mechanisms by which obesity affects airway function (34). For girls becoming overweight or obese between 6 and 11 years the risk of developing new asthma symptoms during early adolescent period increases (35) .

The consumption of soft drinks and snacks in dietary studies is probably higher than reported (36). Food items considered unhealthy and snacks between the meals are most likely to be underreported, and in the present study the intake of soft drinks, sweets and snacks is

probably higher. This underreporting naturally results in a lower energy intake than actually consumed, which is supported by the relatively high percentage of underestimation which was calculated in the present study, 18-25%, (according to Goldberg's cut-off value (27)), table 4. It is common that self-reported dietary data often results in underreporting of energy intake (37). Low motivation and issues surrounding body image may also influence dietary reporting in adolescence (38). Adolescents also have unstructured eating patterns with frequent out-of-home eating, lacking knowledge and limited interest about food and food preparation techniques (39;40). Since the percentage of under-reporters with a history of asthma, current asthma and control subjects is on the same level, the relatively high percentage of underestimation is of less importance for comparisons between the groups.

In the present study, there was no statistical difference between the intake of fruits and vegetables among asthmatic subjects and healthy controls in agreement with Tabak et al (41). In a study from Saudi Arabia the consumption of vegetables was significantly lower in children with a history of asthma or wheeze the last 12 months (42). An intervention study showed that the consumption of fruit rich in vitamin C, even at a low level of intake, reduced wheezing symptoms in childhood (9). Others have showed a positive association between frequency of fresh fruit consumption and lung function (43) and that low intakes of vitamin A, C, E was associated with reduced lung function (10). It is, however, difficult to compare studies, since they vary in lung function measures, in how asthma/wheeze is defined, and in how the dietary recordings are recorded. Some claim that several intervention studies based on dietary advice to increase the intake of fruits and vegetables are needed, including standardized lung function measures (42). In the present study the intake of vitamin C was satisfactory for all groups compared to the NNR. The present evidence from the limited

number of randomised-controlled trials is insufficient to identify a specific role for vitamin C in the prevention or management of asthma (8).

To our knowledge the present study is the first dietary research study in adolescents with asthma in Norway. Anthropometric data is also lacking for this group. While it is known that there is a marked increase in overweight among Norwegian adolescents (44), and that they have a high E% of added sugars and a low intake of fruits and vegetables (18), it is not surprising to find similar results in adolescents with asthma. However, it must be taken into account that the increased consumption of sugar-containing soft drinks and snacks (in those with current asthma) also might be a sign of an unhealthy lifestyle in other aspects, e. g. reduced physical activity. Studies have reported decreased activity among children with a diagnosis of asthma (45;46). The physical activity of the adolescents in the present study is recorded and will be published elsewhere.

To our knowledge no other studies have used a similar method to record food intake (four day recording using food diaries) in adolescents with asthma. The method used in the present study has been validated in 13 years old adolescents, and the energy intake was found to be underestimated by 34% and 24% (two separate validation studies) compared with energy expenditure measured by the activity monitor Acti Reg® (47). Food frequency questionnaires (FFQ) is the most common method used in dietary research. Tabak et al used a FFQ developed for adults, and claimed that non-validated questions and questionnaires were used to assess dietary intake in most studies on diet and asthma in childhood (41). Another study among asthmatic children concludes that in-depth analysis of food intake based on daily diaries should be used in future dietary research (48), as in the present study. The percentage of underestimation (according to "Goldberg factor" (37)) is relatively high, table 4, but not

unlike other dietary surveys using the same method among adolescents (47). Underreporting of energy is influenced by body weight, with obese subjects more likely than normal weight subjects to underreport energy intake (49). Our findings support this, showing a lower mean energy intake in the overweight asthmatics (1.3 MJ lower (mean value)) compared to the normal weight asthmatics. Being less time-consuming is the advantage of using a pre-coded diary compared with traditional methods like weighed records, 24 hour recall and dietary history (38). Interviewed adolescents found it easy to fill in the food diary with 10-15 minutes daily required to complete the diary (38). A validation study showed that the photographic booklet is a useful tool for portion size estimates in this age group (25). In the present study, the adolescents also found it simple to register their data. They hardly ever had questions when they were contacted the second day in the registration period.

There are few overweight adolescents in the present study, and this limits the use of the dietary data from this group. Statistical analysis (between overweight and normal weight adolescents) were therefore not performed. The present study used reference BMI curves published by Cole et al (23) to estimate the prevalence of overweight and obesity. In the discussion of the International Task Force on Obesity (IOTF) cut offs, Chinn emphasizes the value of comparison they facilitate and is positive to the principles that underlay the IOTF definitions (50). The cut-offs for WC in Dutch children (based on the IOTF cut-off criteria for overweight and obesity) were used in the present study (24). WC has lately been considered to be a more useful measure than waist/hip ratio (WHR) (24).

In the present study the adolescents with asthma were representative for the 1019 children included in the 10-year follow up as there were no significant differences with respect to weight, height, lung function and bronchial hyper responsiveness. The adolescents are

recruited from a general population based birth cohort, and cases and controls are from the same cohort. The inclusion criteria are the same for both cases and controls (except for asthma which is required for the cases). The controls are the children born closest in time to a defined case. They were not matched by gender as this neutralizes the natural imbalance of asthma prevalence between the genders. As the present study is a case-control study, the results can be used to describe these asthmatic adolescents and their controls and to identify factors associated with asthma (since this cohort is representative), but further statement is necessary.

In conclusion, the present study shows that the intake of sugar-containing soft drinks is significantly higher in asthmatic adolescents than in healthy adolescents. The intake of snacks is also significantly higher in those with current asthma. The results support, though not statistically significant, other studies showing a higher prevalence of overweight in asthmatics. All adolescents had a higher E% from saturated fat and added sugar than recommended, while the intake of fruits and vegetables, fibre, vitamin D, calcium and magnesium was lower than recommended. The present study suggests that there is a potential of improvement of the diet for all girls and boys included. Following the dietary recommendations will also prevent obesity. There is a demand for additional dietary research in asthmatics.

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Conflict of interest

The authors are not aware of any conflict of interest.

Reference List

(1) Asher MI, Montefort S, Bjorksten B, Lai CK, Strachan DP, Weiland SK, et al. Worldwide time trends in the prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and eczema in childhood: ISAAC Phases One and Three repeat multicountry cross-sectional surveys. Lancet 2006 Aug 26;368(9537):733-43.

(2) Burr ML, Wat D, Evans C, Dunstan FD, Doull IJ. Asthma prevalence in 1973, 1988 and 2003. Thorax 2006 Apr;61(4):296-9.

(3) Braun-Fahrlander C, Gassner M, Grize L, Takken-Sahli K, Neu U, Stricker T, et al. No further increase in asthma, hay fever and atopic sensitisation in adolescents living in Switzerland. Eur Respir J 2004 Mar;23(3):407-13.

(4) Lodrup Carlsen KC, Haland G, Devulapalli CS, Munthe-Kaas M, Pettersen M, Granum B, et al. Asthma in every fifth child in Oslo, Norway: a 10-year follow up of a birth cohort study. Allergy 2006 Apr;61(4):454-60.

(5) Devereux G, Seaton A. Diet as a risk factor for atopy and asthma. J Allergy Clin Immunol 2005 Jun;115(6):1109-17.

(6) Harik-Khan RI, Muller DC, Wise RA. Serum vitamin levels and the risk of asthma in children. Am J Epidemiol 2004 Feb 15;159(4):351-7.

(7) Rubin RN, Navon L, Cassano PA. Relationship of serum antioxidants to asthma prevalence in youth. Am J Respir Crit Care Med 2004 Feb 1;169(3):393-8.

(8) Ram FSF, Rowe BH, Kaur B. Vitamin C supplementation for asthma. Ram FSF , Rowe BH, Kaur B Vitamin C supplementation for asthma Cochrane Database of Systematic Reviews : Reviews 2004 Issue 3 John Wiley & Sons , Ltd Chichester, UK DOI : 10 1002 /14651858 CD000993 pub2 2004.

(9) Forastiere F, Pistelli R, Sestini P, Fortes C, Renzoni E, Rusconi F, et al. Consumption of fresh fruit rich in vitamin C and wheezing symptoms in children. SIDRIA Collaborative Group, Italy (Italian Studies on Respiratory Disorders in Children and the Environment). Thorax 2000 Apr;55(4):283-8.

(10) Gilliland FD, Berhane KT, Li YF, Gauderman WJ, McConnell R, Peters J. Children's lung function and antioxidant vitamin, fruit, juice, and vegetable intake. Am J Epidemiol 2003 Sep 15;158(6):576-84.

(11) Nja F, Nystad W, Lodrup Carlsen KC, Hetlevik O, Carlsen KH. Effects of early intake of fruit or vegetables in relation to later asthma and allergic sensitization in school-age children. Acta Paediatr 2005 Feb;94(2):147-54.

(12) Chinn S. Obesity and asthma. Paediatr Respir Rev 2006 Sep;7(3):223-8.

(13) Bibi H, Shoseyov D, Feigenbaum D, Genis M, Friger M, Peled R, et al. The relationship between asthma and obesity in children: is it real or a case of over diagnosis? J Asthma 2004 Jun;41(4):403-10.

(14) Gold DR, Rotnitzky A, Damokosh AI, Ware JH, Speizer FE, Ferris BG, Jr., et al. Race and gender differences in respiratory illness prevalence and their relationship to environmental exposures in children 7 to 14 years of age. Am Rev Respir Dis 1993 Jul;148(1):10-8.

(15) Oddy WH, Sherriff JL, de Klerk NH, Kendall GE. Breastfeeding, body mass index, and asthma and atopy in children. Adv Exp Med Biol 2004;554:387-90.

(16) Flaherman V, Rutherford GW. A meta-analysis of the effect of high weight on asthma. Arch Dis Child 2006 Apr;91(4):334-9.

(17) Lucas SR, Platts-Mills TA. Paediatric asthma and obesity. Paediatr Respir Rev 2006 Dec;7(4):233-8.

(18) Overby NC, Lillegaard IT, Johansson L, Andersen LF. High intake of added sugar among Norwegian children and adolescents. Public Health Nutr 2004 Apr;7(2):285-93.

(19) Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. Lancet 2001 Feb 17;357(9255):505-8.

(20) Popkin BM, Nielsen SJ. The sweetening of the world's diet. Obes Res 2003 Nov;11(11):1325-32.

(21) Nordic Council of Ministers. Nordic nutrition recommendations 2004. Integrating nutrition and physical activity. 4th edn. Norden, Copenhagen, Denmark. 2005.

(22) Lodrup Carlsen KC. The environment and childhood asthma (ECA) study in Oslo: ECA-1 and ECA-2. Pediatr Allergy Immunol 2002;13 Suppl 15:29-31.

(23) Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000 May 6;320(7244):1240-3.

(24) Fredriks AM, van BS, Fekkes M, Verloove-Vanhorick SP, Wit JM. Are age references for waist circumference, hip circumference and waist-hip ratio in Dutch children useful in clinical practice? Eur J Pediatr 2005 Apr;164(4):216-22.

(25) Lillegaard IT, Overby NC, Andersen LF. Can children and adolescents use photographs of food to estimate portion sizes? Eur J Clin Nutr 2005 Apr;59(4):611-7.

(26) Rimestad AH Løken EB Nordbotten A. The Norwegian food composition table and the database for nutrient calculations at the Institue for Nutrition Research. Nor J Epidemiol (in Norwegian) 2005;10:7-10.

(27) Goldberg GR, Black AE, Jebb SA, Cole TJ, Murgatroyd PR, Coward WA, et al. Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivation of cut-off limits to identify under-recording. Eur J Clin Nutr 1991 Dec;45(12):569-81.

(28) Andersen LF, Overby N, Lillegaard IT. [Intake of fruit and vegetables among Norwegian children and adolescents]. Tidsskr Nor Laegeforen 2004 May 20;124(10):1396-8.

(29) National Directorate for Health and Social Affairs Dep for Nutrition, www.matportalen.no/Saker/1176272699.98/artikkel_print.pt. 2007.

(30) Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr 2006 Aug;84(2):274-88.

(31) Popkin BM. Dynamics of the nutrition transition and its implications for the developing world. Forum Nutr 2003;56:262-4.

(32) Shore SA. Obesity and asthma: implications for treatment. Curr Opin Pulm Med 2007 Jan;13(1):56-62.

(33) Stenius-Aarniala B, Poussa T, Kvarnstrom J, Gronlund EL, Ylikahri M, Mustajoki P. Immediate and long term effects of weight reduction in obese people with asthma: randomised controlled study. BMJ 2000 Mar 25;320(7238):827-32.

(34) Sood A, Dawson BK, Eid W, Eagleton LE, Henkle JQ, Hopkins-Price P. Obesity is associated with bronchial hyper-responsiveness in women. J Asthma 2005 Dec;42(10):847-52.

(35) Castro-Rodriguez JA, Holberg CJ, Morgan WJ, Wright AL, Martinez FD. Increased incidence of asthmalike symptoms in girls who become overweight or obese during the school years. Am J Respir Crit Care Med 2001 May;163(6):1344-9.

(36) Lafay L, Mennen L, Basdevant A, Charles MA, Borys JM, Eschwege E, et al. Does energy intake underreporting involve all kinds of food or only specific food items? Results from the Fleurbaix Laventie Ville Sante (FLVS) study. Int J Obes Relat Metab Disord 2000 Nov;24(11):1500-6.

(37) Black AE, Goldberg GR, Jebb SA, Livingstone MB, Cole TJ, Prentice AM. Critical evaluation of energy intake data using fundamental principles of energy physiology: 2. Evaluating the results of published surveys. Eur J Clin Nutr 1991 Dec;45(12):583-99.

(38) Andersen LF, Pollestad ML, Jacobs DR, Jr., Lovo A, Hustvedt BE. Validation of a pre-coded food diary used among 13-year-olds: comparison of energy intake with energy expenditure. Public Health Nutr 2005 Dec;8(8):1315-21.

(39) Livingstone MB, Robson PJ. Measurement of dietary intake in children. Proc Nutr Soc 2000 May;59(2):279-93.

(40) Rockett HR, Berkey CS, Colditz GA. Evaluation of dietary assessment instruments in adolescents. Curr Opin Clin Nutr Metab Care 2003 Sep;6(5):557-62.

(41) Tabak C, Wijga AH, de MG, Janssen NA, Brunekreef B, Smit HA. Diet and asthma in Dutch school children (ISAAC-2). Thorax 2006 Dec;61(12):1048-53.

(42) Hijazi N, Abalkhail B, Seaton A. Diet and childhood asthma in a society in transition: a study in urban and rural Saudi Arabia. Thorax 2000 Sep;55(9):775-9.

(43) Cook DG, Carey IM, Whincup PH, Papacosta O, Chirico S, Bruckdorfer KR, et al. Effect of fresh fruit consumption on lung function and wheeze in children. Thorax 1997 Jul;52(7):628-33.

(44) Andersen LF, Lillegaard IT, Overby N, Lytle L, Klepp KI, Johansson L. Overweight and obesity among Norwegian schoolchildren: changes from 1993 to 2000. Scand J Public Health 2005;33(2):99-106.

(45) Firrincieli V, Keller A, Ehrensberger R, Platts-Mills J, Shufflebarger C, Geldmaker B, et al. Decreased physical activity among Head Start children with a history of wheezing: use of an accelerometer to measure activity. Pediatr Pulmonol 2005 Jul;40(1):57-63.

(46) Lang DM, Butz AM, Duggan AK, Serwint JR. Physical activity in urban school-aged children with asthma. Pediatrics 2004 Apr;113(4):e341-e346.

(47) Lillegaard IT, Andersen LF. Validation of a pre-coded food diary with energy expenditure, comparison of under-reporters v. acceptable reporters. Br J Nutr 2005 Dec;94(6):998-1003.

(48) Wickens K, Barry D, Friezema A, Rhodius R, Bone N, Purdie G, et al. Fast foods - are they a risk factor for asthma? Allergy 2005 Dec;60(12):1537-41.

(49) Heerstrass DW, Ocke MC, Bueno-de-Mesquita HB, Peeters PH, Seidell JC. Underreporting of energy, protein and potassium intake in relation to body mass index. Int J Epidemiol 1998 Apr;27(2):186-93.

(50) Chinn S. Definitions of childhood obesity: current practice. Eur J Clin Nutr 2006 Oct;60(10):1189-94.

Table 1 Demographic data of adolescents with asthma (history of asthma and current asthma) and control subjects

	History of asthma	**History of asthma**	**Current asthma**	**Current asthma**	**Control**	**Control**
	Boys	Girls	Boys	Girls	Boys	Girls
	n=65	*n=28*	*n=40*	*N=11*	*n=38*	*n=38*
Age (yrs) (min-max)	13.6 (12.7 , 14.3)	13.6 (12.8 , 14.2)	13.6 (12.7 , 14.3)	13.4 (12.9 , 13.9)	13.7 (12.6 , 14.3)	13.5 (12.8 , 14.1)
Height (cm)	163.9 (10.2)	163.7 (5.8)	161.2 (9.2)	163.1 (4.9)	163.6 (7.8)	160.4 (6.1)
Weight (kg)	54.0 (11.3)	51.8 (9.4)	51.6 (11.5)	49.4 (7.6)	52.1 (11.0)	48.9 (8.0)
BMI (kg/m^2)	20.0 (2.9)	19.2 (2.7)	19.7 (3.2)	18.5 (2.2)	19.4 (3.4)	18.9 (2.6)
Waist circumference (cm)	74.4 (10.5)	73.8 (8.4)	72.8 (11.6)	72.6 (6.0)	71.8 (6.8)	72.2 (7.0)
SPT (Skin Prick Test) positive % (n)	52.3 (34)	42.9 (12)	67.5 (27)	36.4 (4)	28.9 (11)	15.8* (6)

Values are mean (SD). Age is mean with range (min-max) and SPT (Skin Prick Test) is percentage % (n).
No significant differences were found.
*1=missing

Table 2 Daily intake of selected food items in 13 yrs old with asthma (history of asthma and current asthma) and control subjects

	History of asthma *n=93*	**Control** *n=76*	**P-value**[a]	**Current asthma** *n=51*	**P-value**[a]
Fruits and vegetables (g)[b]	297 (254-339)	343 (287-399)	0.24	306 (239-373)	0.46
Sugar/sweets(g)	34 (26-43)	37 (31-44)	0.60	31 (21-40)	0.27
Soft drinks with sugar (g)[c]	271 (219-323)	199 (157-242)	0.04 [d]	283 (208-357)	0.05 [d]
Diet soft drinks (g)	165 (108-221)	113 (65-161)	0.16	110 (54-166)	0.94
Carbonated soft drinks with sugar (g)	180 (138-221)	125 (95-155)	0.03[d]	205 (144-266)	0.02[d]
Diet carbonated soft drinks (g)	106 (70-143)	67 (40-94)	0.09	74 (35-115)	0.80
Snacks (g)	10 (6-14)	7 (4-9)	0.10	14 (7-21)	0.04[c]

Values are mean (CI)

[a] Two sample t-test

[b] Fruits and vegetables includes vegetables, potatoes (fresh), fruits, berries and fruit juices

[c] Soft drinks includes sweetened carbonated soft drinks and other sweetened soft drinks, i.e. lemonade and iced tea (diet soft drinks are artificially sweetened soft drinks)

[d] $p \leq 0.05$

Table 3 Daily intake of energy and nutrients in adolescents with asthma (history of asthma and current asthma) and control subjects (supplements included) in comparison with Nordic Nutrition Recommendations (NNR)

	History of asthma	**Current asthma**	**Control**	**NNR**[a]
	n=93	*n=51*	*n=76*	
Energy (MJ)	8.6 (8.0-9.1)	8.6 (7.9-9.3)	8.3 (7.8-8.8)	-
Protein (E%)	15.6 (15.0-16.2)	15.5 (14.7-16.2)	15.3 (14.8-15.8)	10-20
Fat (E%)	32.2 (31.2-33.2)	32.2 (30.9-33.5)	31.6 (30.4-32.7)	25-35
Saturated fat (E%)	14.0 (13.5-14.5)	13.8 (13.0-14.6)	13.9 (13.3-14.5)	<10
Monounsaturated fat (E%)	10.6 (10.2-11.0)	10.8 (10.2-11.3)	10.3 (9.8-10.7)	10-15
Polyunsaturated fat (E%)	5.3 (5.0-5.6)	5.3 (5.0-5.7)	5.1 (4.8-5.4)	5-10
Carbohydrate (E%)	52.1 (51.0-53.3)	52.3 (50.8-53.7)	53.1 (51.8-54.4)	50-60
Added sugars (E%)	13.8 (12.4-15.1)	13.7 (11.9-15.5)	13.7 (12.7-14.8)	≤10
Fibre (g)	16.0 (13.9-18.1)	16.7 (13.1-20.4)	16.4 (14.6-18.2)	25-35
Retinol equivalent (µg)	1,077 (918-1236)	1,017 (817-1.216)	1,153 (1.010-1.296)	600
α-Tocopherol (µg)	9.8 (8.5-11.2)	9.2 (7.7-10.7)	9.5 (8.5-10.6)	7 (8)[b]
Vitamin D (µg)	5.1 (4.0-6.2)	5.2 (3.6-6.7)	5.0 (4.0-6.0)	7.5
Thiamin (mg)	1.3 (1.1-1.4)	1.1 (1.0-1.3)	1.2 (1.1-1.3)	1.0 (1.2)[b]
Riboflavin (mg)	1.6 (1.4-1.8)	1.5 (1.3-1.6)	1.6 (1.4-1.7)	1.2 (1,4)[b]
Folate (µg)	202 (179-225)	187 (163-212)	195 (179-210)	200
Vitamin C (mg)	97 (83-111)	92 (72-113)	94 (80-108)	50
Calcium (mg)	879 (788-969)	858 (742-975)	868 (800-936)	900
Iron (mg)	11 (10-13)	10 (9-12)	11 (10-12)	11
Magnesium (mg)	264 (241-286)	272 (236-308)	263 (243-283)	280

Values are mean (CI).
No significant differences were found.
[a] Nordic Nutrition Recommendations 2004 (21)
[b] Values for boys in paranthesis

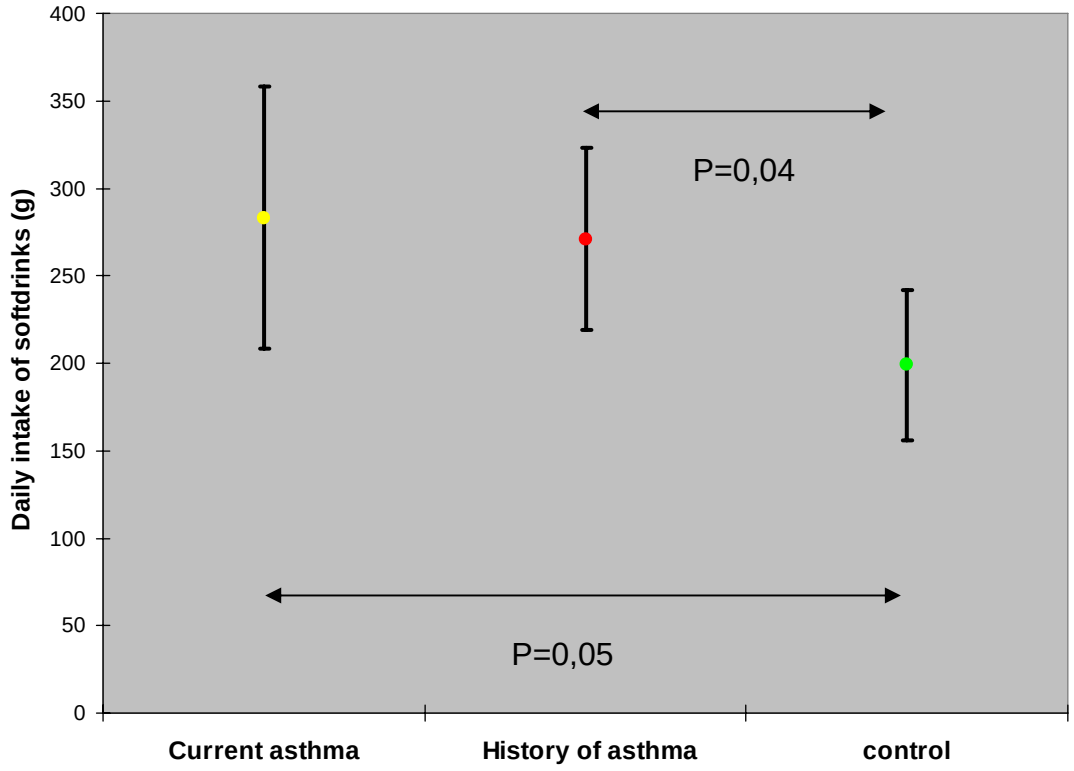
Table 4 Percentage underestimating their energy intake for adolescents with history of asthma, current asthma and control subjects

Gender	BOYS			GIRLS		
	History of asthma	**Current asthma**	**Control**	**History of asthma**	**Current asthma**	**Control**
Case/control	n=65 mean	n=40 mean	n=38 mean	n=28 mean	n=11 mean	n=38 mean
Percentage underestimating their energy intake (n)[a,b]	23.1% (15)	22.5% (9)	18.4% (7)	25.0% (7)	18.2% (2)	18.4% (7)

[a] Using equations for predicting BMR from weight (kg) and height (m). 1985 FAO/WHO/UNU report and the Commission of the European Communities, 1992 (Nordic Nutrition Recommendation 2004 (21))

[b] Using Goldberg's cut- off values for underestimation.(27)

Figure 1 Daily intake of sugar-containing soft drinks in asthmatic adolescents (current asthma, n=51 and history of asthma, n=93.) and control subjects (n=76.).



Attachments

1. Invitation letter

2. Consent form

ULLEVÅL universitetssykehus

NORGES IDRETTSHØGSKOLE

ASTMALIV - AStma, Trening, MAt og LIVsstil

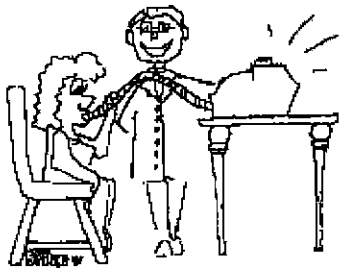
Hei!

Vi sender dette brevet til deg fordi du for noen år siden var med i en undersøkelse om astma og allergi ved **Ullevål sykehus**. Vet du hva astma og allergi er? Kanskje kjenner du noen som har astma eller allergi? Astma er en sykdom som kan gjøre at det blir tungt å puste og som en må bruke medisiner mot. Allergi er når en reagerer på for eksempel hund, katt, husstøv eller gress ved at nesen blir tett, øynene klør, det blir vanskeligere å puste eller en får utslett.

Nå skal vi gjøre en ny undersøkelse. Her skal vi undersøke hvordan det vi spiser, fysisk aktivitet og hvordan god kondisjon påvirker kroppen vår. Forskere har funnet ut at hvordan vi spiser og hvor mye vi beveger oss kan være med på å bestemme om vi får astma. Blir du med på denne undersøkelsen kan du være med på å hjelpe oss å forstå hvorfor en får astma. Du hjelper også barn og unge som allerede har astma.

Hva skal du gjøre?

Dersom du svarer ja til å være med, må foreldrene dine først sende inn svarskjemaet som ligger bakerst i brevet. Så må du møte opp på Norges idrettshøgskole en gang. Under testen du skal være med på, skal du først puste i et apparat som er koblet til en datamaskin. Her skal vi måle hvor store lunger du har, og hvor fort du klarer å blåse inn i apparatet. Dette har du gjort før. Etter dette skal du løpe på en tredemølle samtidig som du puster inn i en ventil. Ventilen er nesten som en snorkel. Her skal vi måle hvor mye oksygen du puster ut. Vi kan da måle kondisjonen din. Du skal også ha på deg et lite mage-/brystbelte som måler hvor fort hjertet ditt slår. Under løpingen må du løpe helt til du ikke orker mer. Løpetesten likner på det du gjorde ved forrige besøk på Ullevål sykehus, men testen er noe "snillere". Løpetesten varer ca. femten minutt. Du skal også puste helt vanlig i et apparat hvor vi samler opp lufta du puster ut. Ingen av testene gjør vondt, men du blir sliten etter løpetesten.



Etter du har vært hos oss på Norges idrettshøgskole får du med deg et skjema hvor du i fire dager skal skrive ned hva du spiser. Dette kan sikkert foreldrene dine hjelpe til med. Du får også med deg en liten boks som du skal ha i beltet ditt. Boksen måler hvor mye du beveger deg, og du skal gå med den i fire dager.

Alt vi måler og all informasjon om deg lagres på en datamaskin. Her lagres ikke navn og personlige opplysninger. Opplysningene tas bort om du ikke lenger vil være med i prosjektet.

Det er helt frivillig å være med. Om du i løpet av prosjektet finner ut at du ikke har lyst til å være med lengre, er dette helt greit. Lurer du på noe er det bare å ringe oss. Telefonnummer står nederst på arket.

Vennlig Hilsen

Sveinung Berntsen (forsker),
Barnesenteret, Ullevål universitetssykehus og
Norges idrettshøgskole

Telefon: 23 26 20 00
Kai-Håkon Carlsen (professor og doktor), Voksentoppen
BKL, Astma- og allergisenter og Norges idrettshøgskole

SAMTYKKE

TIL FORELDRE/FORESATTE

JEG/VI HAR LEST INFORMASJONSSKRIVET OM FORESPØRSEL OM Å DELTA I FORSKNINGSPROSJEKTET:
"***ASTMALIV***- ASTMA, TRENING, MAT OG LIVSSTIL", OG GIR MIN/VÅR TILSLUTNING TIL AT BARNET KAN DELTA I UNDERSØKELSEN.

JEG/VI ER KJENT MED AT VI NÅR SOM HELST KAN TREKKE OSS FRA PROSJEKTET UTEN Å MÅTTE OPPGI GRUNN FOR DET. JEG/VI ER KLAR OVER AT DE INNSAMLEDE DATA UTELUKKENDE BRUKES TIL FORSKNING.

JEG/VI SAMTYKKER I AT DET ETTER GODKJENNING FRA DATATILSYNET, KAN INNHENTES OPPLYSNINGER OM BARNET FRA MEDISINSK FØDSELSREGISTER OG FRA NORSKE SYKEHUS.

BARNETS NAVN (SKRIVES MED BLOKKBOKSTAVER):
. . . . . .

. . . . . .

JEG/VI KAN NÅS PÅ TELEFON (DAGTID):
TLF:. . . . . .

. . . . . .

BOSTEDSADRESSE:. . . . . .

. . . . . .

. . . . . .

VENNLIGST OPPGI HVILKEN SKOLE BARNET GÅR PÅ HØSTEN/VÅREN 2005/06.

SKOLE:
. . . . . .

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. . . . . .

DATO:

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. . ..

FORESATTES UNDERSKRIFT:

. . ..
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. . ..

TIL DEG SOM ER BARN/UNGDOM

JEG HAR LEST INFORMASJONEN OG VET AT JEG KAN TREKKE MEG NÅR JEG VIL UTEN Å OPPGI GRUNN.
JEG VIL VÆRE MED I PROSJEKTET.

DATO:

. . ../. . .. .-
. . ..

DIN UNDERSKRIFT:

. . ..
. . ..
. . ..

SAMTYKKET RETURNERES TIL ULLEVÅL UNIVERSITETSSYKEHUS *INNEN EN UKE* I DEN FERDIG ADRESSERTE KONVOLUTTEN. PORTO ER BETALT.

3. Precoded food diary (18 pages)

4. Photographic booklet

5. Instruction folder

Dagbok

Fyll inn:

Kjønn ☐ Skriv 1 hvis gutt/mann, 2 hvis jente/kvinne

Alder ☐☐ år

Ukedag ☐ 1=mandag, 2=tirsdag, 3=onsdag, 4=torsdag, 5=fredag, 6=lørdag og 7=søndag

Dato ☐☐.☐☐.☐☐

Var denne dagen en vanlig dag? Skriv ja eller nei i rutene.

☐☐☐

Hvis det var en uvanlig dag, forklar hvorfor denne dagen var uvanlig:

Hvor finner jeg matvarene i dagboken?

HUSK:

Alt du spiser/drikker skal skrives opp

Sett ikke kryss i dagboken

Sett bare bokstaver i de orange rutene

Sett bare tall i de sorte rutene

Drikke

For størrelsen på glasset du drikker av, se bildeserie 1.
Fyll inn bokstaven i den orange ruten.

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Vann	glass					
Helmelk, søt/sur (eks. helmelk, kefir)	glass					
Lettmelk, søt/sur (eks. lettmelk, Cultura)	glass					
Ekstra lett lettmelk	glass					
Skummet melk	glass					
Drikkeyoghurt	glass					
Sjokolademelk av helmelk (eks. O'boy, Nesquick)	glass					
Sjokolademelk av lettmelk (eks. Nesquick, Litago)	glass					
Sjokolademelk av ekstra lett lettmelk (eks. O'boy)	glass					
Sjokolademelk av skummet melk (eks. O'boy, Nesquick)	glass					
Litago sjokolademelk	1/2 liter					
Kakao av helmelk	kopp					
Kakao av lettmelk	kopp					
Kakao av ekstra lett lettmelk	kopp					
Kakao av skummet melk	kopp					
Appelsinjuice	glass					
Eplejuice/eplemost	glass					
Nektar (eks. eple, tropisk frukt, annen frukt)	glass					
Brus med sukker (eks. Cola, Solo)	glass					
Brus med sukker (eks. Cola, Solo)	1/2 liter					
Brus, kunstig søtet (eks. Cola light, Solo lett)	glass					
Brus, kunstig søtet (eks. Cola light, Solo lett)	1/2 liter					

Drikke forts.

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Saft med sukker (eks. husholdning, appelsin, solbær)	glass					
Saft, kunstig søtet (eks. Fun light)	glass					
Mineralvann (eks. Farris)	glass					
Mineralvann (eks. Farris)	1/2 liter					
Energidrikk (eks. Battery)	boks (330 ml)					
Te, vanlig (eks. Earl Grey, solbær)	kopp					
Fruktte (eks. nype, kamille)	kopp					
Iste/urtete med sukker	glass/pakning (250 ml)					
Kaffe, kokt (eks. presskanne)	kopp					
Kaffe, traktet/filter	kopp					
Kaffe, pulver (instant)	kopp					
Caffe latte, Cappucino	glass/kopp (4dl)					
Espresso	kopp (1dl)					
Sukketter/Natrena/ Canderel	stk					
Sukker til te/kaffe	teskje/ biter					
Melk til te/kaffe	spiseskje					

Annet
beskriv best mulig hva, hvor mye og når:

Øl, vin, brennevin

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Alkoholfritt øl, vørterøl (eks. Clausthaler, Munkholm)	glass					
Lettøl	boks/flaske (330 ml)					
Pilsner	boks/flaske (330 ml)					
Sterkøl	boks/flaske (330 ml)					
Rusbrus (eks. Cider, Bacardi breezer)	boks/flaske (330 ml)					
Hvitvin	glass					
Rødvin	glass					
Brennevin	dram (4 cl)					

Annet
beskriv best mulig hva, hvor mye og når:

Brød m.m.

Skriv antall skiver i sort rute. For tykkelse på brødskiven se bildeserie 2 og fyll inn bokstaven i orange rute.

1 skive = 1/2 rundstykke

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Loff/fint rundstykke	skiver					
Mellomgrovt brød, grovt rundstykke, kneippbrød	skiver					
Grovt brød	skiver					
Dansk rugbrød, Pumpernikkel	skiver					
Baguette/Ciabatta	stk					
Knekkebrød lyst, skonrok, kavring	stk					
Knekkebrød, mørkt	stk					
Lompe, potetlefse	stk					
Pølsebrød, hamburgerbrød	stk					
Pitabrød	stk					
Flatbrød (eks. Mors flatbrød, Ideal)	stk					

Smør eller margarin på brød.

1 skive = 1/2 rundstykke = 1 knekkebrød
= 2 vaffelhjerter = 2 kjeks = 1/2 ciabatta

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl.22-6
Meierismør	til antall skiver					
Bremykt	til antall skiver					
Brelett	til antall skiver					
Margarin (eks. Soya, Per, Melange)	til antall skiver					
Lettmargarin (eks. Soft light)	til antall skiver					
Annet beskriv best mulig hva, hvor mye og når:						

Hvor mye smurte du på brødet?

Se bildeserie 3 og skriv bokstaven for det bildet som ligger nærmest opp til den smør-/margarinmengden du brukte på brødet. Hvis du hadde forskjellig mengde smør/margarin på de brødskivene du spiste innenfor det angitte tidsrommet, kan du anslå et gjennomsnitt for skivene.

	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Bildeserie 3					

Pålegg

Du skal oppgi mengde pålegg i forhold til brødskiver. Har du spist to typer pålegg på samme brødskive, fører du opp begge (eks. 1 hvitost helfet og 1 skinke). Hvis du bare har spist pålegg og ikke brød, anslå til hvor mange skiver du kunne brukt dette pålegget.

1 skive = 1/2 rundstykke = 1 knekkebrød
= 2 vaffelhjerter = 2 kjeks = 1/2 ciabatta

Kjøttpålegg	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Servelat, vanlig	til antall skiver					
Kokt skinke, spekeskinke, lett servelat	til antall skiver					
Salami, spekepølse, fårepølse	til antall skiver					
Leverpostei, vanlig	til antall skiver					
Leverpostei, mager	til antall skiver					
Kalkun-/ kyllingpålegg	til antall skiver					

Ost

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Hvitost helfet 27% fett (eks. Jarlsberg, Norvegia)	til antall skiver					
Hvitost halvfet 16% fett (eks. Norvegia lettere)	til antall skiver					
Brunost helfet (eks. Geitost, G35, Fløtemysost)	til antall skiver					
Brunost halvfet, prim	til antall skiver					
Smøreost, vanlig (eks. Baconost, Snøfrisk)	til antall skiver					
Smøreost, mager (eks. mager skinkeost)	til antall skiver					
Kremost (eks. Philadelphia, Gourmetoster)	til antall skiver					
Dessertost (eks. Brie, Gräddost, Ridderost)	til antall skiver					

Fiskepålegg

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Kaviar	til antall skiver					
Røkt laks/ørret	til antall skiver					
Makrell i tomat, røkt makrell	til antall skiver					
Sardiner, sursild, ansjos	til antall skiver					

Syltetøy/søtpålegg

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Syltetøy vanlig, gelé, marmelade	til antall skiver					
Syltetøy lett, frysetøy	til antall skiver					
Honning	til antall skiver					
Peanøttsmør	til antall skiver					
Sjokolade-/nøttepålegg	til antall skiver					
Hapå/Litagopålegg	til antall skiver					

Annet
beskriv best mulig hva, hvor mye og når:

31963

Annet pålegg

1 skive= 1/2 rundstykke= 1knekkebrød
=2 vaffelhjerter= 2 kjeks= 1/2 ciabatta

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Egg, kokt/stekt	til antall skiver					
Majonessalat (eks. italiensk salat, rekesalat)	til antall skiver					
Majonessalat, lett (eks. italiensk salat, lett)	til antall skiver					
Tomat som pålegg	til antall skiver					
Banan som pålegg	til antall skiver					

Annet
beskriv best mulig hva, hvor mye og når:

Pynt på brødskiver

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Majones/remulade, vanlig	til antall skiver					
Majones/remulade, lett	til antall skiver					
Agurk (frisk/syltet)	til antall skiver					
Rødbeter (syltet)	til antall skiver					
Paprika	til antall skiver					

Annet
beskriv best mulig hva, hvor mye og når:

Yoghurt

	Antall	kl. 6-10	kl.10-14	kl.14-18	kl.18-22	kl.22-6
Yoghurt med frukt	beger (175 ml)					
Yoghurt 0,1% fett	beger (125 ml)					
Yoplait frukt	beger (125 ml)					
Litago yoghurt	beger (125 ml)					
Litago yoghurt m/müsli	beger inkl. müsli					
Go'morgen yoghurt m/müsli	beger inkl.müsli					
Piano Duo Yoghurt	beger (125 ml)					

Frokostgryn/grøt

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Havregrøt	bildeserie 5					
Havregryn	bildeserie 4					
Firkorn	bildeserie 4					
Müsli, søtet (eks. Crusli, Solfrokost)	bildeserie 4					
Müsli, usøtet (eks. Go'Dag, Frukt müsli)	bildeserie 4					
Cornflakes	bildeserie 4					
Honnikorn/ Frosties/Chocofrokost	bildeserie 4					
Puffet ris/ havrenøtter/hvetenøtter	bildeserie 4					

Annet
beskriv best mulig
hva, hvor mye og når:

Melk/sukker/syltetøy brukt sammen med frokostgryn og grøt

3 teskjeer=1 spiseskje

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Helmelk, søt/sur	dl					
Lettmelk, søt/sur	dl					
Ekstra lett lettmelk	dl					
Skummet melk, søt/sur	dl					
Syltetøy vanlig, gelé, marmelade	teskjeer					
Syltetøy lett, frysetøy	teskjeer					
Sukker	teskjeer					

Annet
beskriv best mulig
hva, hvor mye og når:

For drikkeyoghurt som tilbehør til frokostgryn og grøt se side 2
For yoghurt som tilbehør til frokostgryn og grøt se side 7

Kjøtt og kjøttretter

Pølse	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Grillpølse/wienerpølse, vanlig	stk					
Grillpølse/wienerpølse, lett	stk					
Kalkun/kyllingpølse	stk					
Middagspølse/ kjøttpølse/medisterpølse	kjøttpølse (15cm)					
Middagspølse/ kjøttpølse, lett	kjøttpølse (15cm)					

Kjøttretter/pizza

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Karbonader	stk					
Kjøttkaker/medisterkaker	stk					
Elg-/reinkarbonader	stk					
Snitzel (eks. ostesnitzel)	stk					
Løvstek	skiver					
Hamburger med brød (eks. vanlig, McDonalds mfl.)	stk					
Tacoskjell med kjøttdeig og salat	fylte skjell					
Pitabrød med kjøtt og salat	fylte pita					
Kebab	fylte pita					
Kjøttdeigsaus/tomatsaus med kjøttdeig	bildeserie 11					
Lasagne	stk (10x8cm)					
Moussaka	stk (10x8cm)					
Pizza, trekantstykker	bildeserie 12					
Pizza, firkantstykker	bildeserie 13					

Annet
beskriv best mulig hva, hvor mye og når:

For lompe, pølsebrød og hamburgerbrød se side 4
For ketchup og sennep se side 14
For kokt pasta (uten saus) se side 13

Kjøtt forts.

Rent kjøtt	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Biff (okse, lam, svin)	stykker					
Koteletter (svin, lam, okse)	koteletter					
Stek (svin, lam, okse)	skiver					
Skinke (Bayonne, hermetisk)	skiver					
Elg-/hjort-/reinsdyrstek	skiver					
Grillet kylling	1/4 kylling					
Kyllingfilet	fileter					
Bacon	skiver					

Gryteretter	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Risotto	bildeserie 11					
Fårikål	bildeserie 11					
Lapskaus	bildeserie 11					
Gryterett (basis) med kjøttdeig/pølser	bildeserie 11					
Gryterett med elg-/hjort-/reinsdyrkjøtt	bildeserie 11					
Gryterett med får-/okse-/svinekjøtt	bildeserie 11					
Leverretter	bildeserie 11					

Annet
beskriv best mulig hva, hvor mye og når:

For saus se side 14

Fisk og fiskeretter

Fiskefarse

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Fiskeboller	stk					
Fiskekaker/fiskepudding	stk/skiver					

Ren fisk

Torsk/sei, kokt/bakt	stykke					
Torsk/sei, stekt	bildeserie 14					
Laks/ørret, kokt/bakt	stykke					
Laks/ørret, stekt	bildeserie 14					
Makrell, kokt	stykke					
Makrell, stekt	bildeserie 14					
Flyndre/steinbit, kokt	stykke					
Flyndre/steinbit, stekt	bildeserie 14					

Tillagede fiskeretter og fiskepinner

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Fiskepinner	stk					
Panert fisk	stk					
Fiskegryte/suppe med fisk	tallerken (3 dl)					
Fiskegrateng	stk (10x8cm)					

Reker og fiskeinnmat

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Reker (uten skall)	bildeserie 9					
Torskerogn	skiver					
Fiskelever	spiseskjeer					

Annet
beskriv best mulig hva, hvor mye og når:

Andre retter

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Risengrynsgrøt (For sukker se s. 8 og smørøye s. 5)	bildeserie 5					
Pannekaker (For sukker og syltetøy se s. 8)	stk					
Suppe (eks. blomkål, tomat)	tallerken (3dl)					
Ertesuppe/betasuppe	tallerken (3dl)					
Kjøttsuppe (eks. Trøndersodd)	tallerken (3dl)					
Omelett	antall egg i stykket					
Eggerøre	til antall skiver					
Ostepai	stykke (10x8cm)					
Pasta med tomatsaus uten kjøtt	bildeserie 6					
Pasta med hvit saus (eks. carbonara)	bildeserie 6					

Vegetarrett
beskriv hva (oppskrift), hvor mye og når:

Annet
beskriv best mulig hva, hvor mye og når:

Blandet salat med kjøtt/fisk/skalldyr

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Blandet salat med kjøtt/skinke	bildeserie 10					
Blandet salat med skalldyr/fisk	bildeserie 10					
Blandet salat med tunfisk	bildeserie 10					
Blandet salat med pasta	bildeserie 10					

Annet
beskriv best mulig hva, hvor mye og når:

For dressing se side 14

Potet/ris/pasta

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Potet, kokt	stk					
Potet, bakt	stk					
Potetmos	bildeserie 7					
Gratinerte poteter	bildeserie 7					
Pommes frites	bildeserie 8					
Potetsalat med majones/rømmedressing	spiseskjeer					
Potetsalat med oljedressing	spiseskjeer					
Ris, kokt (eks. parboiled, naturris)	bildeserie 6					
Ris, kokt (eks. jasmin, basmati, hurtigris)	bildeserie 6					
Pasta, kokt (eks. spaghetti, makaroni, tagliatelle)	bildeserie 6					
Nudler (eks Mr.Lee)	pose					

Annet
beskriv best mulig hva, hvor mye og når:

Grønnsaker

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Gulrot	stk					
Kålrot	skive					
Brokkoli	bildeserie 9					
Blomkål	bildeserie 9					
Hodekål	skalk					
Surkål	spiseskjeer					
Råkost (gulrot, blandet av flere grønnsaker)	bildeserie 9					
Grønnsaksblanding, fryst (eks. amerikansk blanding)	bildeserie 9					
Blandet salat (eks. kinakål, mais, tomat og agurk)	bildeserie 10					

Grønnsaker forts.

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Stekte grønnsaker (eks. wokblanding)	bildeserie 9					
Tomat	skiver/båter					
Paprika	ringer					
Mais	spiseskjeer					
Løk, stekt	spiseskjeer					
Ertestuing	spiseskjeer					

Annet
beskriv best mulig hva, hvor mye og når:

Saus/dressing

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Hvit saus	spiseskjeer					
Ostesaus	spiseskjeer					
Brun saus	spiseskjeer					
Smeltet smør/ margarin	spiseskjeer					
Tomatsaus (uten kjøtt)	spiseskjeer					
Ketchup	spiseskjeer					
Sennep	spiseskjeer					
Bernaisesaus ol.	spiseskjeer					
Dressing, vanlig (eks. Thousand Island)	spiseskjeer					
Dressing, lett (eks. Thousand Island light)	spiseskjeer					
Olje- og eddikdressing	spiseskjeer					
Seterrømme 35% fett	spiseskjeer					
Lettrømme 20% fett	spiseskjeer					
Majones/remulade, vanlig	spiseskjeer					
Majones/remulade, lett	spiseskjeer					

Annet
Beskriv best mulig hva, hvor mye og når:

Is/dessert

Is

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl.22-6
Is (eks. vanilje, krokan, sjokolade)	bildeserie 15					
Yoghurtis (eks. Dream, Living Lite)	bildeserie 15					
Ispinne (eks. Gullpinne, Pinup)	stk					
Kremmerhus (eks. Kroneis, Kronevaffel)	stk					
Saftispinne (eks. Lollipop)	stk					

Gelé, pudding, fromasj

Gelé (eks. sitron, jordbær)	bildeserie 15					
Pudding (eks. sjokoladepudding)	bildeserie 15					
Riskrem, multekrem, fromasj	bildeserie 5					
Risifrutti med saus	beger					

Hermetisk frukt, fruktgrøt

Fruktcoctail	bildeserie 5					
Ananas (ring), pære/fersken (halv)	stk					
Fruktgrøt, kompott	bildeserie 5					

Annet
beskriv best mulig hva, hvor mye og når:

Dessertsauser/krem

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Fløte	spiseskjeer					
Krem, pisket	spiseskjeer					
Sjokoladesaus	spiseskjeer					
Karamellsaus	spiseskjeer					
Vaniljesaus	spiseskjeer					

Annet
beskriv best mulig hva, hvor mye og når:

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Kaker, gjærbakst

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Boller	stk					
Julekake, kringle	skive/stykke					
Skolebrød, skillingsbolle	stk					
Wienerbrød, wienerkringle	stk					
Vafler (Se syltetøy s. 6, se rømme s. 14)	hjerter					
Eplekake, pai med frukt/bær	stykker					
Formkake, muffins	skive/stk					
Sjokoladekake	stykker					
Marsipankake, bløtkake	stykker					
Fyrstekake, nøttekake	stykker					
Smultring	stk					
Kokosbolle	stk					

Kjeks	**Antall**	**kl. 6-10**	**kl. 10-14**	**kl. 14-18**	**kl. 18-22**	**kl. 22-6**
Kjeks (eks. Mariekjeks, Gjende), småkaker	stk					
Fylte kjeks (eks. Ballerina, Monaco, Pepita)	stk					
Havrekjeks (eks. Bixit, Sibas)	stk					
Smørbrødkjeks (eks. Kornmo, GoldenCrisp)	stk					
Smørbrødkjeks (eks. Kaptein, Start)	stk					
Salte kjeks (eks. Ritz, Salinas)	stk					
Kjeks med sjokolade (eks. Maryland cookies, Bixit med sjokoladetrekk)	stk					

Annet
beskriv best mulig hva, hvor mye og når:

31963

Frukt/bær	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Eple	stk					
Banan	stk					
Pære	stk					
Appelsin	stk					
Mandarin/klementin	stk					
Druer	stk					
Fersken/nektarin	stk					
Melon, vann	skive					
Melon, eks. cantalup	skive					
Jordbær (friske/frosne)	stk					
Rosiner	neve					
Kiwi	stk					

Annet
beskriv best mulig hva, hvor mye og når:

Snacks	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Potetgull, vanlig (1 neve= 8 flak)	neve					
Potetgull, vanlig	pose (300g)					
Potetgull, lett/ potetskruer (1 neve= 8 flak)	neve					
Potetgull, lett/ potetskruer	pose (300g)					
Ostepop (1 neve= 8 ostebuer)	neve					
Maischips (1 neve= 8 flak)	neve					
Peanøtter	pose (100g)					
Popcorn	neve					
Dip (eks. rømme m/dipmix)	spiseskjeer					

Annet
beskriv best mulig hva, hvor mye og når:

31963

Godterier

Sjokolade/konfekt	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Melkesjokolade (Melkesjokolade, Firkløver, Helnøtt)	plate (100g)					
Melkesjokolade (Melkesjokolade, Firkløver, Helnøtt)	ruter					
Mørk kokesjokolade	staver/4 ruter					
Marsipan med sjokolade (eks. Gullbrød, marsipangris)	som Gullbrød (65g)					
Sjokoladebiter (eks. Twist, konfekt)	biter					
Kinderegg	stk					
Snickers, Japp	stk (85g)					
Kjekssjokolade (eks. Kvikklunsj, Twix)	som Kvikklunsj (46g)					
Gelesjokolade (eks.Troika)	stk					
New Energy	stk					

Smågodt	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Lakris (eks. "salte sild", lakrisbåter)	stk					
Gelégodt (eks. seigmenn, vingummi, "colaflasker")	stk					
Skumgodt (eks. "viskelær", "sopp", marshmellows)	stk					
Syrlige drops (eks. "bringebær", salte og sure bomber)	stk					
Karamell (eks. Fudge, Smørbukk, Fox)	stk					
Godteripose (Godt & blandet, Søppeldynga, Partymix)	pose (150g)					
Kjærlighet på pinne	stk					

Annet
beskriv best mulig hva, hvor mye og når:

31963

Drops/pastiller

	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Drops/pastiller med sukker (eks. kamferdrops, Halslinser, Doc)	stk					
Pastiller, kunstig søtet (eks. Dent)	stk					
Tyggegummi med sukker	stk					
Tyggegummi, kunstig søtet (eks. Extra, V6)	stk					

Annet
beskriv best mulig
hva, hvor mye og når:

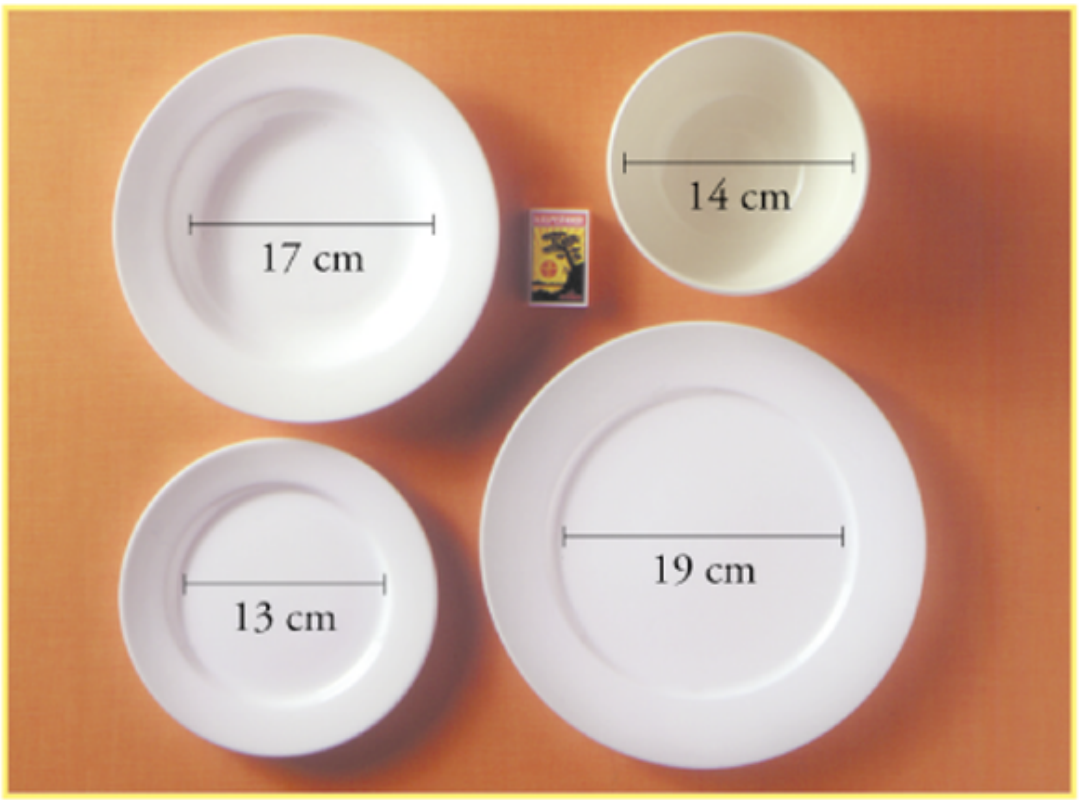
Tran/kosttilskudd

1 barneskje= 5 ml

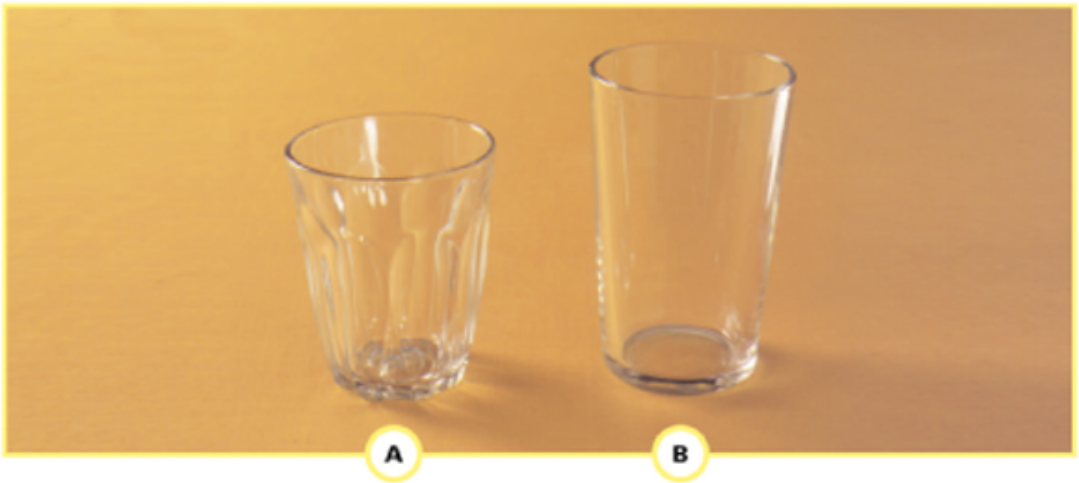
	Antall	kl. 6-10	kl. 10-14	kl. 14-18	kl. 18-22	kl. 22-6
Tran	barneskje					
Trankapsler	stk					
Sanasol	barneskje					
Biovit	barneskje					
Multivitamin (eks. Vitaplex, Vitamineral)	stk					
Fluortabletter	stk					
Jerntabletter (9mg)	stk					
Folat (400 µg)	stk					

Annet
beskriv best mulig
hva, hvor mye og når:

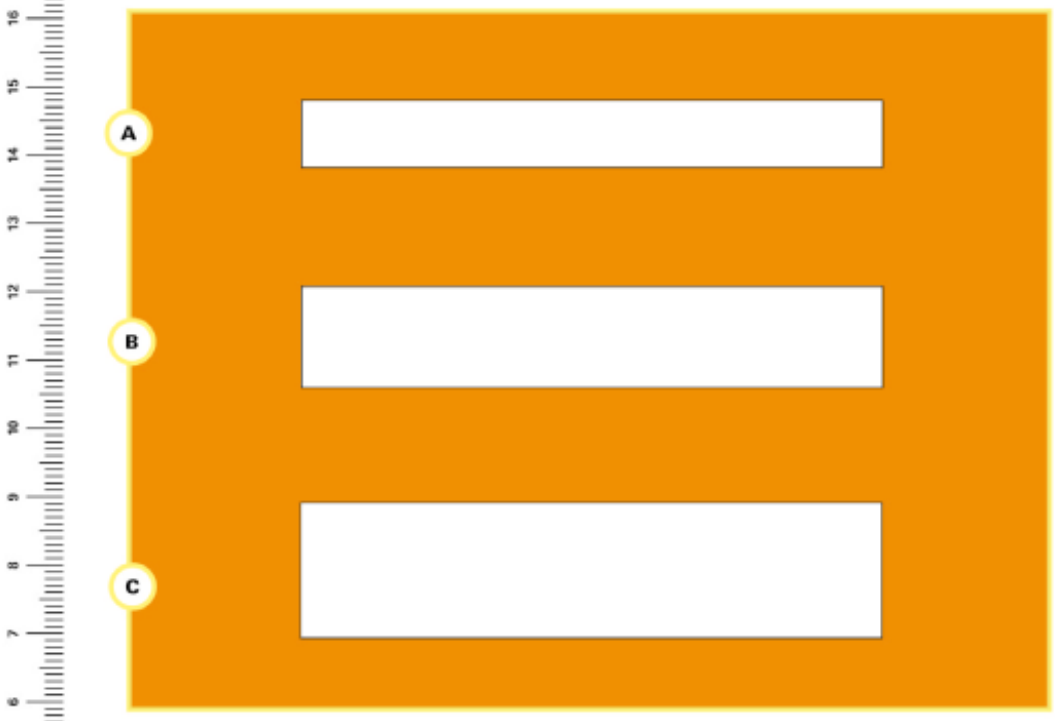
DETTE BILDET VISER STØRRELSEN PÅ TALLERKENENE SOM ER BRUKT I BILDEHEFTET



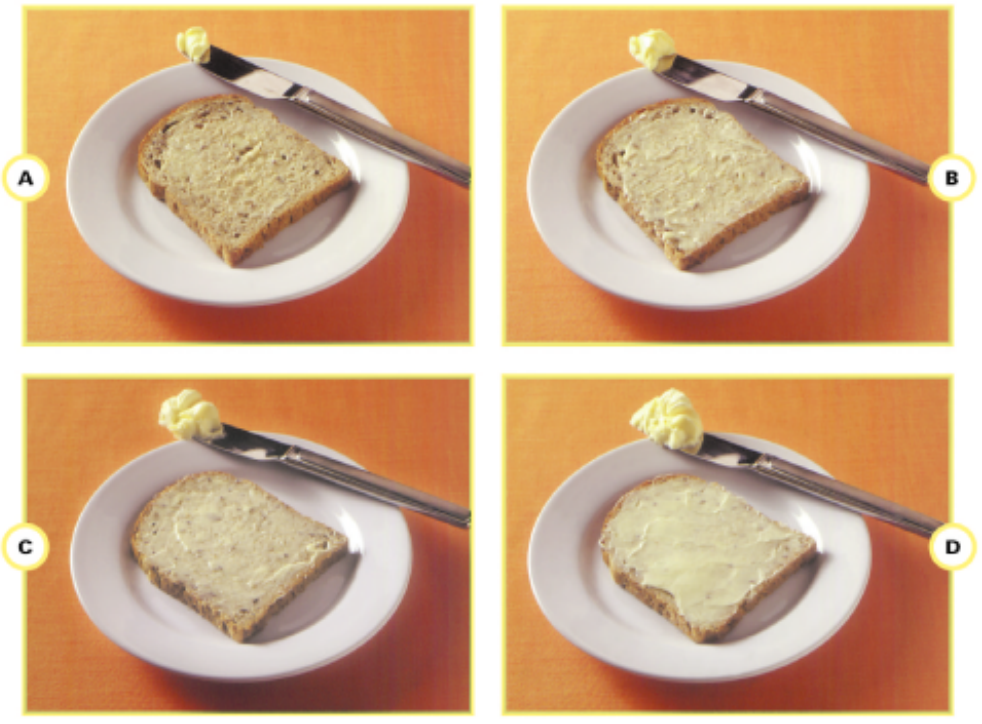
1. GLASS



2. BRØDTYKKELSE

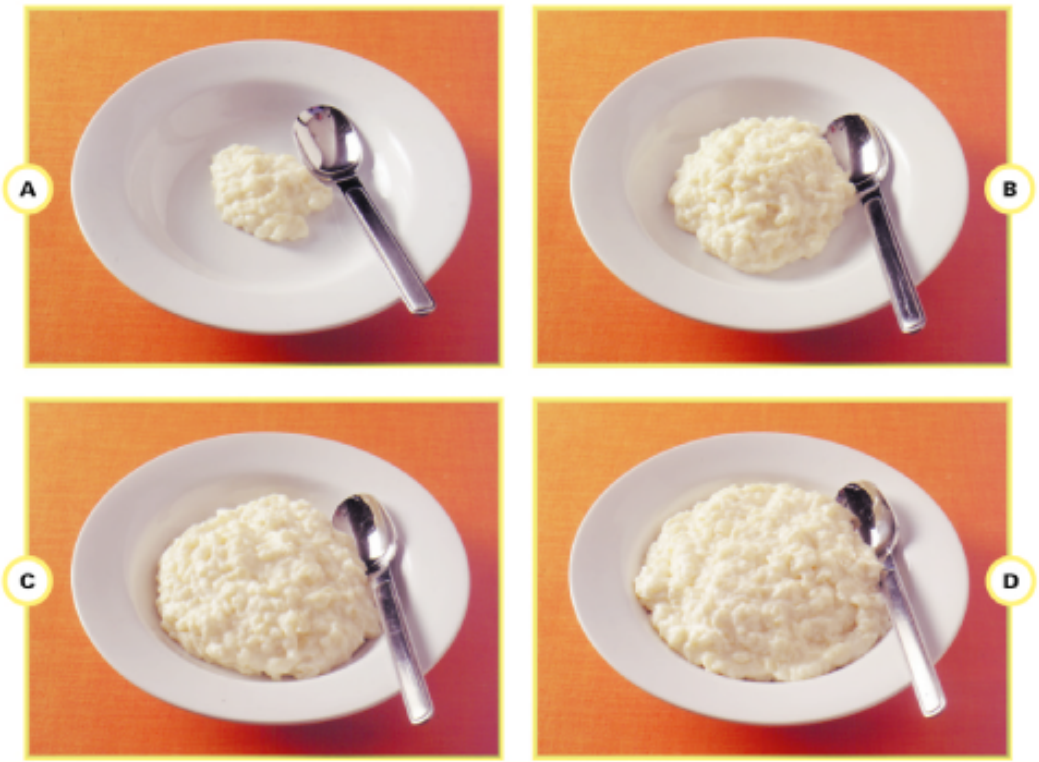


3. SMØR/MARGARIN PÅ BRØD

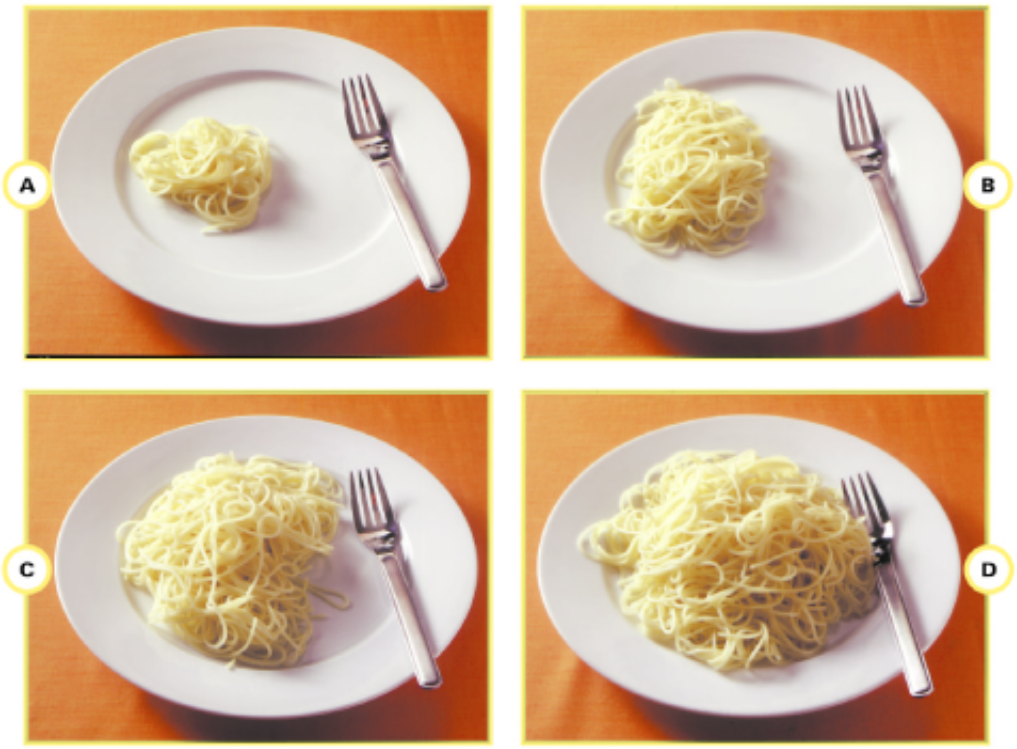


4. CORNFLAKES (FROKOSTBLANDING)

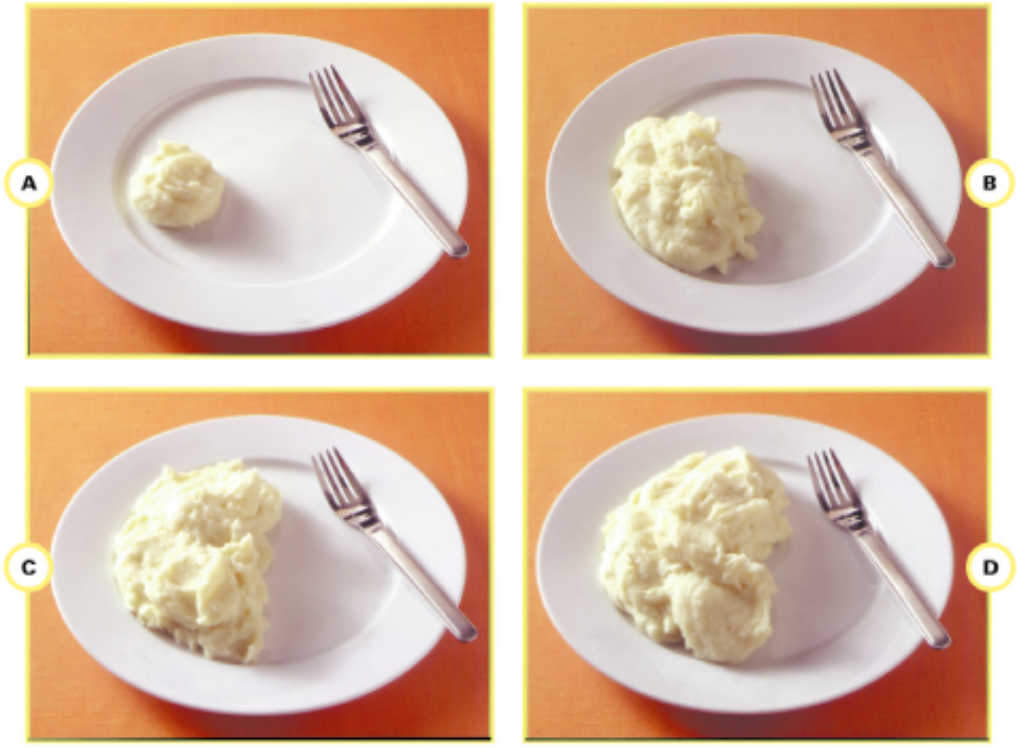
5. GRØT



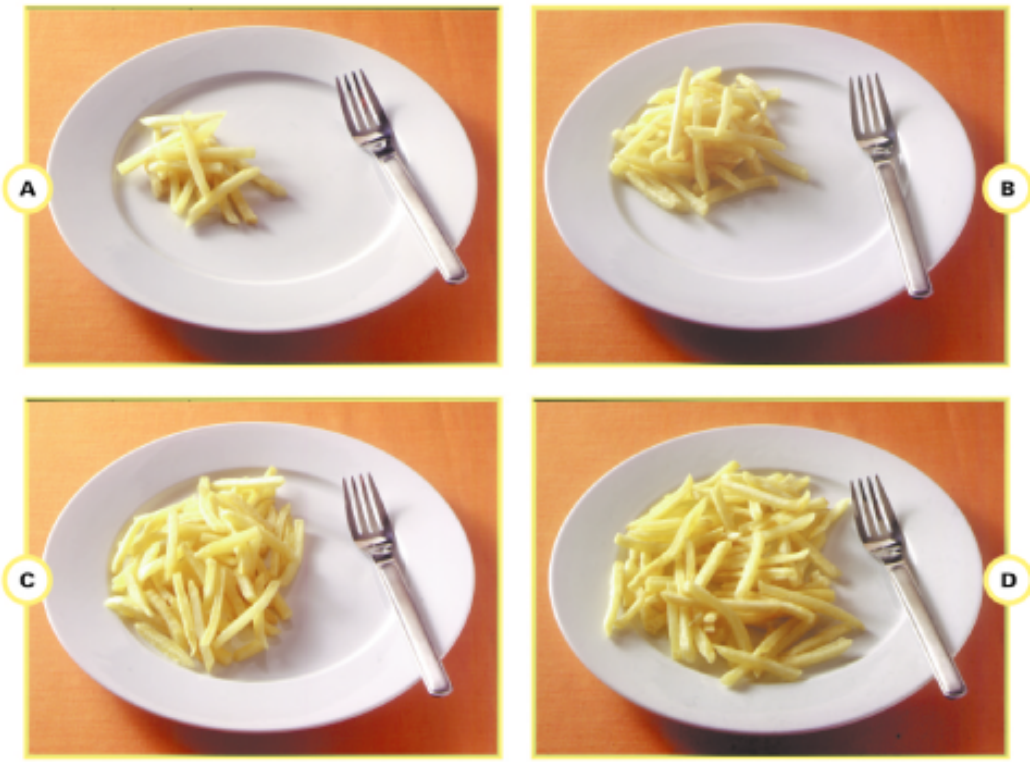
6. SPAGHETTI / PASTA (RIS)



7. POTETMOS

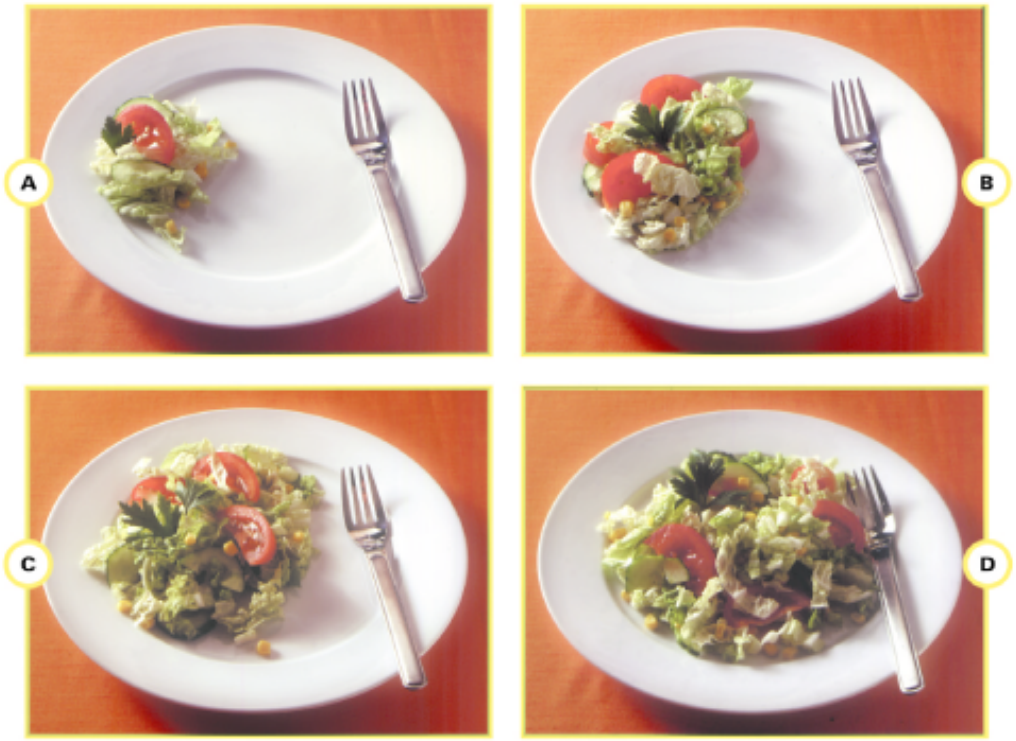


8. POMMES FRITES



9. GRØNNSAKSBLANDING (RÅKOST)

10. SALAT

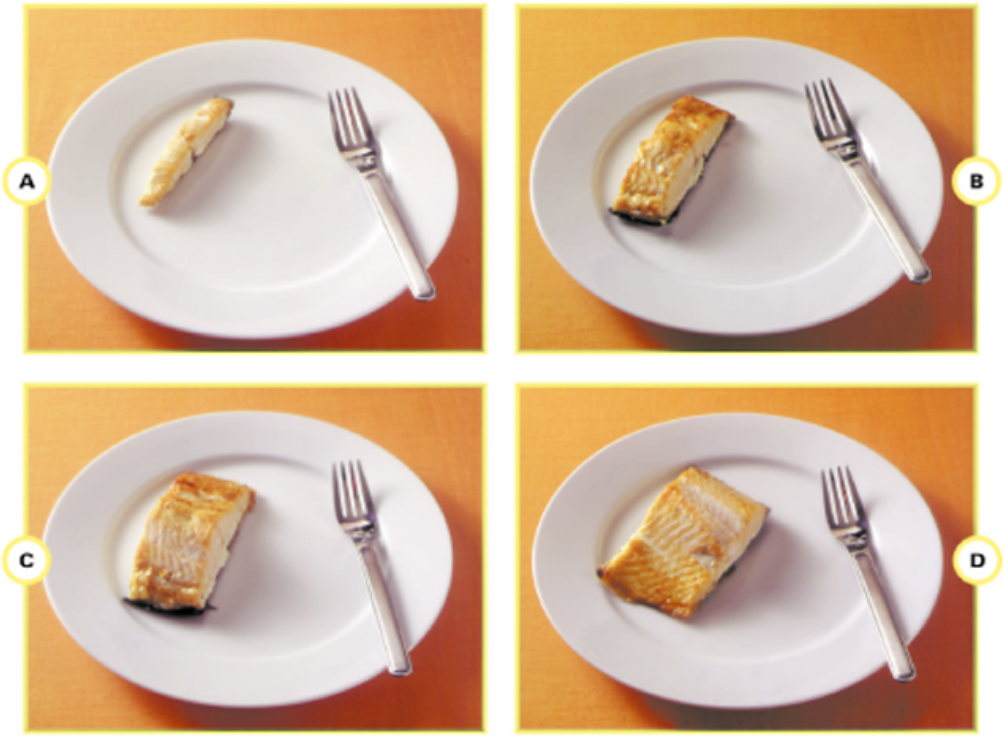


11. KJØTTSAUS (LAPSKAUS)

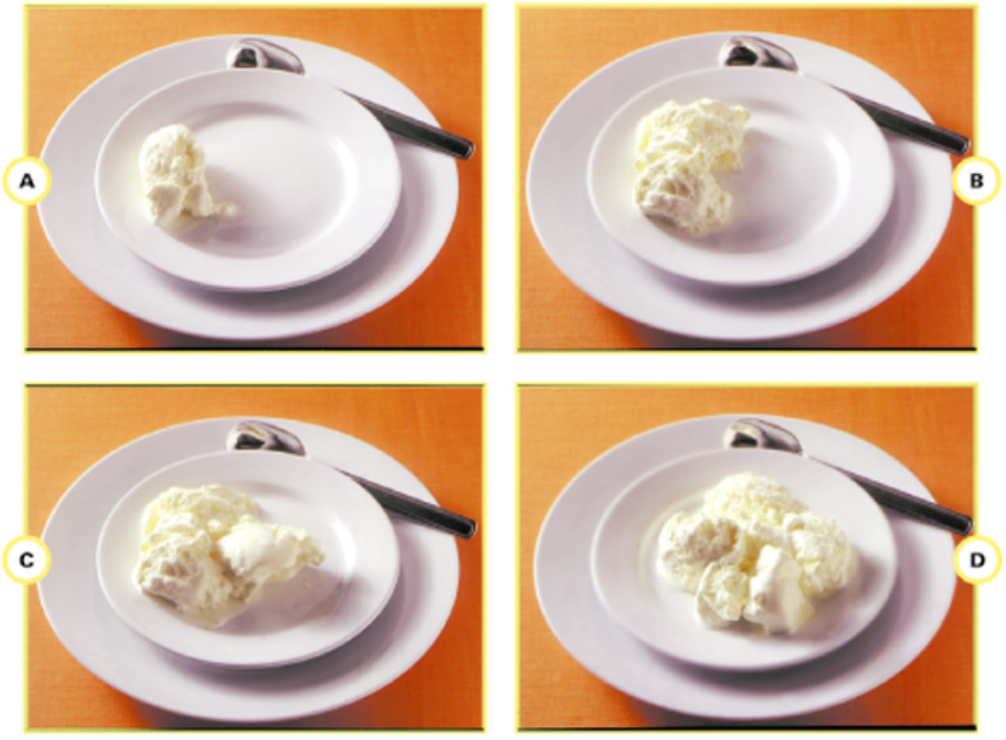
12. PIZZA, TREKANTSTYKKER

13. PIZZA, FIRKANTSTYKKER

14. FISK



15. IS (PUDDING)



Kort veiledning om utfylling av dagboken

ASTMALIV

AStma, Trening, MAt og LIVsstil

Råd om utfylling av dagboken

Takk for at du har sagt ja til å delta!

I denne delen av undersøkelsen skal kosten din registreres. Vi bruker for enkelhets skyld "du" gjennom hele dette heftet, som om det er ungdommen som leser. La gjerne en voksen lese heftet også. Spør hvis det er noe du lurer på!

For å få et best mulig bilde av det du spiser og drikker vil vi vite HVA og HVOR MYE du spiser og drikker i løpet av fire dager.

Det som hører til kostholdsundersøkelsen og som ligger i mappen er:
- Heftet "Kort veiledning om utfyllling av dagboken"
- Fire dagbøker, én for hver registreringsdag
- Fire hjelpeark som kan brukes til hjelp ved utfylling av dagboken
- Et bildehefte til hjelp ved beskrivelse av HVOR MYE som blir spist/drukket
- Tilleggskjema, kosttilskudd

I tillegg finner du:
- Et brev med dato for når registreringen skal utføres
- En frankert svarkonvolutt

Kosten skal registreres de dagene som er angitt i brevet som følger med materiellet.

Dag 1 .....

Dag 2 .....

Dag 3 .....

Dag 4 .....

Du skal registrere alt du spiser og drikker fra du våkner om morgenen første registreringsdag, til du sovner for natten siste dag i registreringsperioden.

Spis og drikk som du pleier. Det er VIKTIG at du IKKE ENDRER noe på vanene dine i forbindelse med denne undersøkelsen.

Det er VIKTIG at du skriver ned ALT du spiser og drikker i løpet av disse fire dagene.

Hvordan fyller jeg ut dagboken?

Bla gjennom dagboken og bildeheftet, gjerne sammen med foreldre/foresatte, slik at dere blir kjent med innholdet. På de siste sidene i denne informasjonen er det eksempler på hvordan dagboken fylles ut.

Forsiden

På forsiden av hver dagbok skal du fylle inn kjønn, alder, hvilken ukedag det er, dato og om det var en vanlig eller uvanlig dag. På forsiden finner du også en oversikt over hvor du finner de ulike matvarene i heftet.

Tidsbolker

Legg merke til at en dag er delt inn i 5 tidsbolker (eks. kl. 6-10, kl. 10-14). Fire av disse er på 4 timer, mens den siste strekker seg fra kl. 22 om kvelden til kl. 06 neste morgen.
Du skal skrive ned hvor mye du har spist eller drukket i de aktuelle tidsbolkene. Har du begynt å spise i en tidsbolk og sluttet i den neste, skriver du alt i den tidsbolken du begynte.

Absolutt alt du spiser og drikker skal registreres

For hver matvare/drikke er det oppgitt en enhet. For eksempel skal drikke angis i antall glass, og brød i antall skiver. Du skal for alle matvarer angi hvor mange enheter du har spist/drukket. Du kan skrive hele tall som 1, 2, 3 eller deler som ¼ eller 1½ for alle matvarer og drikker i dagboken. Antallet skal fylles inn i de sorte rutene.

Skriv bare bokstaver i de oransje rutene

For noen matvarer må du se i bildeheftet, for å angi hvor mye du har spist. Ved disse matvarene er det vist til den bildeserien du må se på.

Bildeseriene består av fire alternativer merket A, B, C, D. Velg det alternativet som stemmer best med hvor mye du har spist. Du skriver bokstaven inn i den oransje ruten.

Enkelte matvarer skal du sammenligne med bilder som ikke ligner på det du har spist. Her skal du kun bruke bildene til å se hvor stor plass matvaren du spiser tar på tallerkenen.

Spiser du flere porsjoner av ulik størrelse, må du tenke hvordan alle porsjonene ville

sett ut til sammen. Har du eksempelvis spist to porsjoner av spagetti, en som ligner på B og en annen på A, kan du skrive 1 ½ B.

Skriv det som ligner mest på det du til sammen spiste.

Sett ikke kryss i dagboken

Det skal aldri brukes kryss i dagboken. Det skal kun brukes tall og bokstaver.

Når matvaren ikke er i dagboken

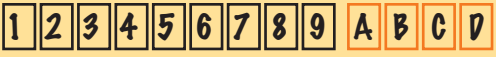
Spiser du matvarer/matretter som ikke finnes oppført i dagboken, må du beskrive nøye det du har spist, hvor mye og når du har spist i de åpne boksene "Annet – beskriv best mulig hva, hvor mye og når".

Praktisk gjennomføring

Om du skriver i dagboken nøyaktig hva du har spist/drukket etter at du har spist, eller om du vil notere på hjelpearket og "føre inn" på kvelden, er opp til deg. –Men ikke vent til neste dag, da kan det være lett å glemme noe. Hjelpearket kan være greit å ha med seg på skolen og andre steder hvor det kan bli spist/drukket noe. Bruk eventuelt baksiden av hjelpearket om du vil gjøre mer detaljerte notater.

- **Det er viktig at du ikke bretter eller krøller dagbøkene**.
- **Bruk gjerne myk blyant til å skrive med. Du kan også bruke penn (blå eller sort).**

Du skal skrive tall og bokstaver som vist her:



Lurer du på noe?

Klinisk ernæringsfysiolog Anne Kørner Bueso ved BKL Voksentoppen, Rikshospitalet - Radiumhospitalet HF, ringer den andre dagen i registreringsperioden for å oppklare eventuelle spørsmål eller problemer. Dere kan også ringe eller sende SMS/e-post til henne hvis det er noe dere lurer på i forbindelse med utfylling av dagboken, tlf nr 22 13 65 13/22 13 65 00 (eller eventuelt 41 41 52 32), e-post adresse: anne.korner.bueso@rikshospitalet.no

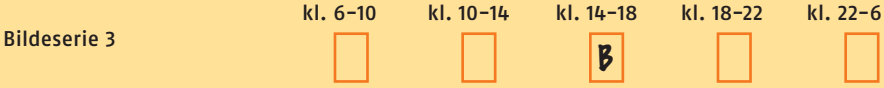
Eksempel

Kari begynner å spise middag kl. 17.45. Hun spiser en porsjon med spagetti og tomatsaus med pølsebiter. I tillegg spiser hun en og en halv skive loff, en halv med soya soft margarin og en uten noe på. Til middag drikker hun ett glass saft. Hun spiser en halv mango til dessert.
Kari tar frem både dagboken og bildeheftet. Hun blar opp på siden for drikke. Hun finner linjen for "Saft med sukker" og i kolonnen "kl. 14-18" skriver hun "1" i en av de sorte rutene. Etter å ha sett i bildeheftet skriver hun "B" i den oransje ruten, da glasset hun brukte lignet mest på B-glasset.

Kari spiste en og en halv skive loff, en halv med soya soft margarin og en uten. Hun blar opp på siden med brød. Hun finner linjen med "loff/fint rundstykke" og skriver 1 ½ i de sorte rutene i kolonnen "kl. 14-18". Hun ser på tykkelsen i bildeheftet og finner at tegning C passer best til brødskivene hun spiste. Hun skriver "C" i den oransje ruten.

Kari finner linjen med margarin og skriver "½" i kolonnen "kl. 14-18".

Deretter ser Kari i bildeheftet og finner at hun brukte samme mengde margarin som på bilde B. Under "Hvor mye smurte du på brødet ?" skriver Kari "B" i den oransje ruten.



Kari spiste en porsjon med spagetti og tomatsaus med pølsebiter. Kari blar opp på sidene med andre retter. Det er to pastaretter å velge mellom. Kari velger "pasta med tomatsaus". Deretter slår hun opp i bildeheftet for å anslå hvor mye pasta og

saus hun spiste. Porsjonen lignet mest på bilde C. Hun skriver derfor “1” i den sorte ruten og “C” i den oransje.

		kl. 6–10	kl. 10–14	kl. 14–18	kl. 18–22	kl. 22–6
Pasta med tomatsaus uten kjøtt	bildeserie 6			1 C		

I tillegg skriver hun hvor mye pølser hun hadde i tomatsausen. Kari finner linjen med ”Grillpølse/wienerpølse vanlig” og skriver “1” i kolonnen ”kl. 14-18”

	Antall	kl. 6–10	kl. 10–14	kl. 14–18	kl.18–22	kl.22–6
Grillpølse/ wienerpølse vanlig	stk			1		

Kari finner ikke mango blant fruktene som er nevnt i dagboken. I boksen ”Annet” etter frukt skriver hun ”Mango, ½ stk, kl. 17.15”.

Annet
Beskriv best mulig hva, hvor mye og når

Mango, 1/2 stk. kl. 17.15

Send inn de fire utfylte dagbøkene **med en gang** etter at registreringsperioden er over.

Legg dem i den ferdig frankerte svarkonvolutten sammen med det andre som skal sendes tilbake, se nærmere informasjon i følgebrevet.

Hvis du har mistet konvolutten kan du bruke følgende adresse:
Norges idrettshøgskole ved/Sveinung Berntsen
Postboks 4014 Ullevål Stadion,
0806 Oslo

NORGES IDRETTSHØGSKOLE

UNIVERSITETET I OSLO
DET MEDISINSKE FAKULTET

ULLEVÅL
universitetssykehus

HELSE ØST

Rikshospitalet – Radiumhospitalet HF

6. **Approvement from the Medical Research Ethics Committee**

7. **Approvement from the Data Inspectorate of Norway**

UNIVERSITETET I OSLO

DET MEDISINSKE FAKULTET

Professor Kai-Håkon Carlsen
UiO

Regional komité for medisinsk forskningsetikk
Sør- Norge (REK Sør)
Postboks 1130 Blindern
NO-0318 Oslo

Telefon: 228 44 666
Telefaks: 228 44 661
E-post: rek-2@medisin.uio.no
Nettadresse: www.etikkom.no

Dato: 15.12.04
Deres ref.:
Vår ref.: S-04331

ASTMALIV- Astma, Trening, Mat og LIVsstil (en oppfølgingsstudie av Miljø og Barneastma)

Komiteen behandlet prosjektet i sitt møte 13.12.04.

Komiteen har ingen merknader til prosjektsøknaden.

Komiteen har følgende merknad til pasientinformasjon og samtykkeerklæring:

1. Siden samtykkeskjemaene er utformet som de er, kan det være en fordel at begrepet frivillig kommer inn også på disse, f.eks. på denne måten: "Jeg har lest informasjonen og vet at det er frivillig å delta, og at jeg kan trekke meg når jeg vil uten å oppgi grunn." Komiteen ber om at samtykkeerklæringene får denne tilføyelsen.

Vedtak:
"Komiteen tilrår at prosjektet gjennomføres. "

Vi ønsker lykke til med prosjektet!

Med vennlig hilsen

Sigurd Nitter-Hauge
Professor dr.med.
Leder

Tone Haug
Rådgiver
Sekretær

Sendes Svenning Bentsen
Kvinne - Barn FOU

Ullevål Universitetssykehus
Barnesenteret, Divisjon Kvinne- Barn
v/ Karin C. Lødrup Carlsen
0407 OSLO

Deres ref	Vår ref (bes oppgitt ved svar)	Dato
	2001/2023-8 HPG/-	21 .06.02

KONSESJON TIL Å BEHANDLE HELSEOPPLYSNINGER

Datatilsynet viser til Deres søknad av 13.05.2002 om konsesjon til å behandle helseopplysninger.

Datatilsynet har vurdert søknaden og gir Dem med hjemmel i helseregisterloven § 5, jf. personopplysningsloven § 33, jf. § 34, konsesjon til å behandle helseopplysninger til følgende formål: "Miljø og barneastma (MBA) studien, del 2: Hvilke faktorer kan bidra til utvikling av astma?"

Konsesjonen er gitt under forutsetning av at behandlingen foretas i henhold til søknaden og de bestemmelser som følger av helseregisterloven med forskrifter.

Det gjøres oppmerksom på at pasientrettighetsloven §§ 4-3 til 4-8 gjelder også for samtykke avgitt etter helseregisterloven, se helseregisterloven § 5 siste ledd.

Dersom det skjer endringer i behandlingen i forhold til de opplysninger som er gitt i søknaden, må dette fremmes i ny konsesjonssøknad.

I medhold av helseregisterloven § 5, jf. § 36, jf. personopplysningsloven § 35, fastsettes i tillegg følgende vilkår for behandlingen:

1. Den databehandlingsansvarlige skal hvert tredje år sende Datatilsynet bekreftelse på at behandlingen skjer i overensstemmelse med søknaden og helseregisterlovens regler.
2. De innsamlede opplysninger må slettes innen 15 år. I den grad det er ønskelig med oppbevaring utover dette, må ny søknad der det redegjøres for det nærmere behovet, fremmes.

Postadresse: Postboks 8177 Dep 0034 OSLO | Kontoradresse: Tollbugt 3 | Telefon: 22 39 69 00 | Telefaks: 22 42 23 50 | Org.nr: 974 761 467 | Hjemmeside: www.datatilsynet.no

3. Dersom personopplysninger skal overføres til utlandet, skal respondentene informeres om dette.
4. Konsesjonen er gitt på den forutsetning at informasjonsskrivet endres som følge av uttalelsene fra Regional komité for medisinsk forskningsetikk.

Med hilsen

Sverre Engelschiøn (e f)
seniorrådgiver

Hanne P. Gulbrandsen
førstekonsulent

(saksbehandler,

telefon 22 39 69 00)